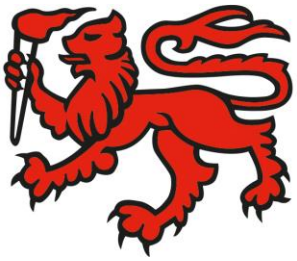

UNIVERSITY of TASMANIA

The pharmacological management of pain in older Australians

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Submitted in fulfilment of the requirements for the degree of a Doctorate of Philosophy

University of Tasmania

October 2016

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Paper 3, Use of opioid analgesics in older Australians: Located in Chapter 6 and Paper 4, Pharmacological management of pain in Australian aged care facilities: Located in Chapter 7. The candidate was the primary author and undertook all data collation, data cleaning, analysis and drafting of the manuscript. Author 1, Author 2 and Author 3 contributed to the idea, methodology, development, editing and refinement of the manuscript.

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Statement of ethical conduct

The research associated with this thesis abides by the international and Australian codes on human and animal experimentation, the guidelines by the Australian Government's Office of the Gene Technology Regulator and the rulings of the Safety, Ethics and Institutional Biosafety Committees of the University.

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Contents

Abstract

Nearly all humans experience acute pain during their lives. Generally, acute pain is short lived, however, up to 20% of adults globally suffer from persistent pain. This prevalence increases with age with up to 50% of elderly people in the community setting and 80% in aged care facilities (ACFs) experiencing persistent pain. Pain, whether acute or persistent can create a significant burden and cost to the patient and society as a whole, through reduced work productivity and health care costs.

In the financial year ending June 2014 analgesics (excluding anti-inflammatories) were the fifth most commonly dispensed class of drug on the Pharmaceutical Benefits Scheme (PBS) in Australia. Six of the top 50 medications on the PBS, by volume, were analgesics or anti-inflammatories. The most frequently dispensed analgesics were paracetamol (with over 6.4 million prescription), followed by paracetamol and codeine (with approximately 3.8 million prescriptions) and then oxycodone (with approximately 3.7 million prescriptions). These figures parallel research findings in Australia and other countries that have found that the consumption of analgesics, particularly opioids, for persistent pain has increased dramatically over the past decades, as a consequence of significant societal reliance on the pharmacological management of pain.

With pain being so prevalent in today's society, evaluating the way in which pain is managed pharmacologically, as well as identifying quality use of medicine (QUM) issues related to its management is paramount to ensure optimal patient outcomes. In addition, increased research activity in pain management has been recommended by the National Pain Strategy [Australia] and the Royal Australasian College of Physician's Opioid Policy, with a focus on assessing attitudes to pain, risk factors for persistent pain conditions and reducing the harms associated with pain management, particularly opioids.

The overarching aim of this thesis was to identify barriers to pain management and make recommendations as to how these could be overcome. Specifically, the research objectives were to:

- Observe how pain is managed pharmacologically in Australian clinical practice;
- Identify predictors for persistent postoperative pain (PPP);
- Identify QUM issues related to the management of pain; and
- Identify barriers to pain management.

These research objectives were investigated through a number of complementary papers, which are described in Chapters Three to Ten. This thesis initially describes the current literature surrounding the pathophysiology and management of pain, and then goes on to detail the eight studies completed as part of this thesis, which investigate the clinical management of pain and how pain management could be improved. The thesis concludes with a discussion about the main areas where QUM issues exist in relation to the management of pain and how these issues and barriers could be overcome.

The study presented in Chapter Three evaluates nearly 170 patients who underwent an operation at the Royal Hobart Hospital (RHH), the major teaching hospital in Southern Tasmania, and discusses the management of pain by patients following discharge from hospital, and the provision of advice regarding pain management provided during their admission. This study found that management of pain by patients was often characterised by underuse of analgesics despite a significant proportion of patients experiencing moderate-severe pain. Additionally this study found that the content of the advice given to patients about pain management and consistency in personnel who provided this advice was highly variable. From this study, it is clear that there is the need for significant improvement in discharge counselling to ensure that patients have sufficient knowledge to safely and adequately self-manage their pain following a hospital separation.

Chapters Four and Five follow patients who underwent orthopaedic surgery or a sternotomy at the RHH for a period of 12 months to evaluate how patients manage their pain throughout this post-surgical period, the effect the pain had on their physical function, the incidence of and potential predictors of PPP and ways to improve pain management. These studies identified a number of patient factors associated with PPP, including pre-operative anxiety, pre-existing pain and younger age. Uncontrolled pain following discharge and symptoms consistent with neuropathic pain following discharge were also associated with PPP, and this is an area that could be addressed to potentially reduce PPP incidence and severity.

Chapters Six and Seven retrospectively evaluated nearly 20,000 Australian patient medication reviews, to identify the prevalence of analgesic use, how analgesics were used in clinical practice and ways that pain management could be optimised. These studies found a lack of concordance between guideline recommendations and the management of pain; specifically maximum opioid doses being exceeded, concurrent use of opioids and benzodiazepines, low use of laxatives in combination with opioids and a failure to optimise use of non-opioid analgesics in patients prescribed opioids.

The final three studies report on the perspectives of general practitioners' (GPs), anesthetists' and nurses' regarding enablers and barriers to optimal pain management and identify ways in which pain management could be improved. Through these complementary studies, a number of barriers to optimal pain management were identified, including:

- Patient stoicism and reluctance to take analgesics;
- Inadequate understanding about pain and its management by patients and health care practitioners;
- Poor and variable post-surgical discharge counselling and patient resources regarding pain management;
- Poor access to pain clinics and allied health professionals;
- Slow hospital-GP communication following a surgical admission;
- A lack of involvement of pain specialists following surgery to manage pain;
- Difficulties in the identification of pain in patients with dementia in ACFs; and
- Poor GP-ACF communication regarding escalation of analgesic orders.

Based on this research a number of recommendations are suggested to improve the management of pain in Australia. These include:

- Increased education and training about pain and its management to undergraduate, graduate and qualified health care practitioners working with patients who experience pain;
- Increased patient education regarding pain, analgesics and expectations of treatment;
- Improved involvement by pain specialists or the Acute Pain Service (APS) following a surgical procedure and at discharge;
- Improved and consistent discharge counselling and post-discharge resources for patients who have undergone a surgical procedure;
- Increased access for persistent pain patients to funded multidisciplinary services including pain clinics, psychologists and physiotherapists; and
- Further research evaluating the effectiveness of the interventions suggested in this thesis, including pharmacist education of patients in GP clinics, increased patient education on surgical discharge, pain specific follow-up after surgery, and the development and validation of a PPP assessment tool.

In summary, pain is currently not well managed in primary care settings by patients or GPs, and there is the need for improvement to optimise patient outcomes. Improved counselling, follow-up and management of post-discharge pain have the potential to reduce the incidence of PPP, and at a minimum, improve the quality of life (QOL) and potential for patients to participate in rehabilitation following surgical discharge. Additionally, improved GP concordance with

guidelines and recommendations may allow for a reduction in harms associated with the use of opioids. These small changes in practice have significant potential to improve patient outcomes and the management of pain in Australia without the need for substantial increases in funding or policy change.

List of Publications

- Veal FC, Bereznicki LRE, Thompson AJ, Peterson GM, Orlikowski CE, 'Pain and functionality following sternotomy: a prospective 12-month observational study', Pain Medicine pp. 1-8. ISSN 1526-2375 (2016). DOI: 10.1093/pm/pnv066
- Veal FC, Bereznicki LR, Thompson AJ, Peterson GM, Orlikowski C, "Subacute pain as a predictor of long-term pain following orthopedic surgery: an Australian prospective 12 month observational cohort study", *Medicine (Baltimore): Analytical Reviews of General Medicine, Neurology, Psychiatry, Dermatology and Pediatrics*, **94** (36) doi:10.1097/MD.0000000000001498 ISSN 0025-7974 (2015)
- Veal, FC and Thompson, AJ, "Paracetamol should remain the first line option for persistent pain", *BMJ*, **350** Article h2221. doi:10.1136/bmj.h2221 ISSN 0959-535X (2015) [Letter or Note in Journal]
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- Peterson, G and Veal, F, "Pain should not be a normal part of ageing", *Australian Pharmacist*, **33** (3) pp. 34-7. ISSN 0728-4632 (2014) [Professional, Refereed Article]
- Veal, FC and Bereznicki, LR and Thompson, AJ and Peterson, GM, "Pharmacological management of pain in Australian aged care facilities", *Age and Ageing*, **43** (6) pp. 851-856. doi:10.1093/ageing/afu072 ISSN 1468-2834 (2014) [Refereed Article]

List of Conference Proceedings

- Veal FC, Bereznicki LRE, Thompson AJ, Peterson GM. Opioid use in community dwelling elderly in Australia. Poster session presented at: the 4th congress of the Association of South East Asian pain Societies. 2013 May 2-5; Singapore.
- Veal FC, Bereznicki LRE, Thompson AJ, Peterson GM. Opioid use in Australian nursing home residents. Poster session presented at: the 4th congress of the Association of South East Asian pain Societies. 2013 May 2-5; Singapore.
- Veal FC, Bereznicki LRE, Thompson AJ, Peterson GM. Opioid use in elderly community dwelling and nursing home patients. Poster session presented at: the 4th congress of the Association of South East Asian pain Societies. 2013 May 2-5; Singapore.

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Abbreviations

ACF	Aged care facilities
ADLs	Activities of daily living
AED	Anti-epileptic drug
APS	Acute Pain Service
AUD	Australian dollar
CABG	Coronary artery bypass graft
CBT	Cognitive behaviour therapy
CCI	Charlson Co-morbidity Index
CHF	Congestive heart failure
CI	Confidence interval
CNS	Central nervous system
COMT	Catechol-O-methyltransferase
COPD	Chronic obstructive pulmonary disease
COX	Cyclooxygenase inhibitor
CPD	Continuing professional development
CR	Controlled release
DASS21	Depression Anxiety Stress Scale 21
DMR	Digital medical record
DNIC	Diffuse noxious inhibitory control
DN4	Douleur Neuropathique 4
EN	Enrolled nurse
FDA	Food and Drug Administration
g	Grams
GP	General practitioner
HADS	Hospital Anxiety and Depression Scale
HMR	Home Medicines Review
IQR	Interquartile range
IR	Immediate release
IV	Intravenous
LAST	Local anaesthetic systemic toxicity
PBS	Pharmaceutical Benefits Scheme
PCA	Patient controlled analgesia
PCS	Pain Catastrophizing Scale
PPP	Persistent postoperative pain
MBS	Medicare Benefits Schedule

MDR1	Multidrug resistant gene 1
MEQ	Oral morphine equivalence
MEQ/d	Oral morphine equivalence per day
mg	Milligram
MOOC	Massive online open course
n	Number
NAPQI	N-acetyl-p-benzo-quinone
NOS	Not otherwise specified
NMDA	N-Methyl-D-Aspartate
NRS	Numerical Rating Scale
NSAIDs	Non-steroidal anti-inflammatories
OR	Odds ratio
QOL	Quality of life
QUM	Quality use of medicines
RA	Rheumatoid arthritis
RHH	Royal Hobart Hospital
RD	Regularly dosed
RMMR	Residential Medication Management Review
RN	Registered nurse
SD	Standard deviation
SNRI	Serotonin noradrenalin reuptake inhibitor
SSRI	Selective serotonin noradrenalin uptake inhibitor
TCAs	Tricyclic antidepressants
TENS	Transcutaneous electrical nerve stimulation
TGA	Therapeutic Goods Administration
VAS	Visual analogue scale
WHO	World Health Organisation

Chapter 1: Introduction

1.1 Background

Pain is one of the most common reasons that patients present to a GP or seek medical assistance (1-3). Nearly all persons in the world experience acute pain in their lifetime, with persistent pain (pain lasting for three months or more) (4) affecting nearly 20% of the world's population (5-11). This prevalence increases with age, with up to 50% of elderly people living in the community and 80% in aged care facilities (ACFs) experiencing persistent pain (12-17). Pharmacological treatment strategies are relied upon predominantly, despite conflicting trial data and the lack of good quality evidence (18-20).

It is difficult to generalise the international literature in relation to the patterns and quality of pain management to the Australian situation due to jurisdictional prescribing requirements and differences in the health care systems. Despite poor quality trial evidence supporting the use of opioid analgesics long-term, there has been a substantial increase in the utilisation of these products globally and in Australia (21-26) as well as treatment duration (22, 27). This increased use has been paralleled by an associated increase in the incidence of adverse events and accidental overdose (27-32). Additionally, pain has been reported to be both undertreated and overtreated (33). These factors have led to concerns regarding the excessive use of opioids and the threat they pose to the public and individual health. Subsequently there has been an attempt to try and optimise pain management and improve the targeting of analgesics. Moreover, there have been an increasing number of organisations and Governments internationally as well as in Australia that have advocated for more research about pain and its management (34-38).

In 2010, Pain Australia published the National Pain Strategy (36). The Pain Strategy's sixth goal is to increase the amount of research being conducted in the field of pain and its management. Areas of research include: evaluation of interventions for persistent pain management, assessing attitudes towards pain and its management, and assessing the safety and efficacy of pain management in older patients (36). Additionally, a policy paper (38) published by the Royal Australasian College of Physicians also suggested further areas for research should include: identification of risk factors for the development of persistent pain conditions, improving the management of persistent pain, and reducing the harms around persistent pain management, specifically opioid use.

The prevalence of pain in Australia is increasing, due in large part to an ageing population. However, pain in older people has many different etiologies. With the prevalence of pain so high

it is important to assess current management of persistent pain irrespective of the indication. However, it is also important to assess how older populations manage acute, subacute and chronic pain to identify if older patients have different predictors of chronicity of pain than younger cohorts. Post-operative pain is a common cause of acute, subacute and persistent pain in all age groups. However, as we age surgical procedures become more commonly required due to an increased number of comorbidities; consequently, post-surgical pain is increasingly affecting older and very old Australians. Surgical procedures provide a unique opportunity to review patients throughout the acute, subacute and persistent pain spectrum to assess predictors of pain and review the way older people self-manage pain during this period. If factors associated with the transition from acute to persistent pain in this older cohort could be identified, potentially it would allow for the development of interventions that will specifically assist older Australians from developing persistent pain.

For these reasons, evaluation of the way in which patients and clinicians manage pain with analgesics and identification of how pain could be managed better are necessary in order to optimise patient outcomes and reduce the inherent risks that these medications have in the patient population as well as society as a whole. This thesis aimed to address these gaps in the literature by conducting a number of inter-related studies with the following objectives:

- To evaluate how pain is managed pharmacologically by patients, nurses, GPs, surgeons and anaesthetists;
- To identify what factors are associated with the development of persistent post-operative pain (PPP);
- To identify quality use of medicine (QUM) issues related to the management of pain; and
- To identify the barriers and enablers to pain management.

1.2 Methodology

A number of related studies were conducted using primarily quantitative methods to retrospectively and prospectively review the management of pain. Additionally, opinions in relation to pain management were obtained from GPs, anaesthetists and nurses, allowing for a diverse perspective of the enablers and barriers to optimal pain management. The patient perspective of pain management was also included in Chapter Three and to a lesser extent in Chapters Four and Five.

To investigate how post-surgical pain is managed pharmacologically by older Australians in the short, medium and longer term, as well as identify predictors of PPP a number of studies were conducted. Chapters Three, Four and Five were prospective studies undertaken at the Royal

Hobart Hospital (RHH). For the study conducted in Chapter Three, patients were recruited through hospital discharge lists following any type of surgery requiring an incision, and then mailed a survey to complete in the week following discharge, regarding their pain management after surgery. Chapters Four and Five involved recruiting and interviewing patients on surgical wards of the RHH who had undergone orthopaedic surgery or a sternotomy, two common procedures older Australians undergo (41, 42, 43, 44) . These patients were then followed over the next 12 months via telephone call interviews conducted at ten days, six weeks, three months and 12 months. Predictors of PPP were identified, as well as recording analgesic use, physical function and pain intensity across the study time period. These studies were conducted in accordance with the STROBE statement for cohort studies (39).

Chapters Six and Seven were retrospective studies of 20,000 Australian medication reviews. Home Medicines Reviews (HMRs) and Residential Medication Management Reviews (RMMRs) are conducted by accredited pharmacists and as part of the process of writing the report to the GPs, data are often entered into various software packages. All patient records entered in one of these packages, Medscope™, was used to assess the patients' medications, medical conditions, and demographics. The data were then analysed to determine the prevalence of analgesic use, characteristics of patients with a documented diagnosis of pain and the quality of pain management.

To better inform recommendations regarding the management of pain in older Australians, we conducted additional studies to incorporate the perspectives of patients, and a range of health care professionals, including GPs, anaesthetists and nursing staff in ACFs. Chapters Eight and Nine were undertaken using online surveys. Anaesthetists practising in both the public and private sectors throughout Australia were emailed an electronic link to the survey. Participants were asked about patient factors associated with acute postoperative pain and PPP, their opinions of the barriers to optimal acute pain management and how their management differed depending on particular patient attributes. GPs in Tasmania were also contacted via the Primary Health Network newsletter and direct emails to general practice clinics to ask them to complete a similar survey. The GPs were asked about their management of pain, which guidelines they use, barriers to pain management and how these could be overcome. Chapter Ten describes a study involving semi-structured interviews conducted with 23 staff at five ACFs in southern Tasmania to explore their views regarding the barriers and enablers to pain management in their context.

Table 1 provides an overview of the thematic structure of this thesis, and identifies the relationship between individual studies and the overall objectives.

Table 1 Thesis objectives and where they are addressed within the text

Objective	Chapters where these objectives are addressed
Observe how pain is managed pharmacologically by patients, nurses, surgeons, GPs and anaesthetists	Patients: Chapters 3, 4, 5 Nurses: Chapters 6, 7, 10 Surgeons: Chapters 3, 4, 5 GPs: Chapters 3, 4, 5, 6, 7, 8, 10 Anaesthetist: Chapters 4, 5, 9
Identify what factors are associated with the development of PPP	Chapters 4 and 5
Identify QUM issues related to the management of pain	Chapters 3, 4, 5, 6, 7, 8, 9, 10
Identify the barriers and enablers to pain management	Chapters 3, 4, 5, 6, 7, 8, 9, 10

1.3 Limitations

These studies were designed to evaluate the management of pain using prescription and over-the-counter analgesic medications in adults in Australia. The use of complementary and alternative medicines, topical preparations and non-pharmacological management strategies were beyond the scope of this study. The management of paediatric pain, end of life pain or pain management associated with active cancers were also beyond the scope of this study due to substantial differences in the management, duration, and drug dosing protocols with these types of pain.

For some of the studies the data relied on patients' recall over the previous week and were unable to be cross-matched with discharge information, which is liable to some inaccuracies, although these were likely to be relatively minimal. For the data reported in Chapters Six and Seven, there were potential limitations associated with the accuracy of pain diagnoses, and the recording of 'as required' analgesics; however, due to the number of participants in these studies, these limitations were unlikely to affect the overall findings. In addition, non-pharmacological management strategies were not recorded in this data set; consequently, this may have overestimated the proportion of patients being suggested as inadequately managed. There was the potential of self-selection bias in Chapters Three, Eight and Nine, which may have been biased towards prescribers or patients interested in the area of pain management, or those with specific or strong perspective that may affect the generalisability of the results. However the results were consistent with other studies, further larger scale studies in these areas would be beneficial, particularly evaluating GP practice throughout Australia to improve the generalisability of the data. The data presented in this thesis provide a comprehensive snapshot of the management of

pain in a number of situations with analgesics and allows for QUM issues to be identified and recommendations to be made to optimise the management of pain in Australia.

1.4 Ethics

The research contained within this thesis abides by all Australian and International guidance surrounding human research ethics. Each study within this thesis was approved by the University of Tasmania's Health and Medical Human Research Ethics Committee (approval reference numbers: H0012833; H0015044; H0014453; H0015249) or the University of Tasmania's Social Sciences Human Research Ethics Committee (approval reference number: H0012404).

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Chapter 2: Pathophysiology and management of pain

2.1 Pain

Pain, although experienced by most people throughout history, has varying individual or cultural significance. The perceived causes of, and treatments for pain have also varied significantly throughout the ages, based on the knowledge, understanding and societal beliefs at that time (45). Traditionally, pain was often thought to be associated with the effect of evil spirits, a punishment for sins or as a trial to strengthen one's faith or resolve (45). However, as more scientific research has been undertaken a greater understanding of the pathophysiology of pain, has resulted in a greater emphasis on a biomedical model and more recently the biopsychosocial approach to pain management (46). Despite an increased understanding of the pathophysiology of pain there are many aspects of pain that remain unclear, including the transition from acute to persistent pain (47).

Pain is defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (4). This definition emphasises the importance of the biopsychosocial model of health in noting pain is also an emotional experience and thus should not be managed solely using a biomedical approach. This is because pain perception, predisposition to persistent pain and analgesic efficacy are influenced by many factors, including a person's biology and psychology, together with environmental and social factors (46, 48, 49). Factors influencing pain perception and progression will be discussed further in section 2.1.3 of this literature review.

Pain is a significant issue within modern society. Persistent pain is often considered a public health priority or challenge (50, 51) and musculoskeletal conditions are one of the Australian Government's priority health areas (52). Additionally, there is also a National Pain Strategy in Australia, which is currently in the process of being updated (36). With an estimated one in five adults experiencing persistent pain (5-11), it is not surprising that the economic burden within society is large (53-56). There is substantial disability associated with persistent pain, resulting in increased absenteeism from work, increased health care utilisation and increased risk of hospitalisation and mortality (9, 55-58). As recognition of the significant patient and societal burden that pain creates, pain was also included as the "fifth vital sign" in 1998 by the United States Veteran's Health Administration, which required it to be recorded at all clinical encounters in this population (59). This has since been adopted more widely by the medical profession (48, 60, 61).

2.1.1 Classifications, definitions and assessment of pain

2.1.1.1 Classification and definitions of pain

There are a number of different ways in which pain can be classified. Generally, more than one of the classifications will be used to describe a person's pain. This may be a description of the underlying cause of pain, for example osteoarthritis, gout or rheumatoid arthritis (RA). Alternatively it can be classified based on the location, for example, lower back pain, abdominal pain or headache; or based on duration and frequency. Acute pain is defined as "pain of recent onset and probable limited duration. It usually has an identifiable temporal and causal relationship to injury or disease" (62). Whereas persistent pain (or chronic pain) is defined as pain lasting more than three months (62). Persistent pain can either be chronic or intermittent in nature (47).

Pain can also be categorised based on the underlying pathology, for example, nociceptive pain which is pain associated with actual or potential damage to non-neural tissues, or neuropathic pain which is due to damage to the somatosensory nervous system (63). Patients can also experience mixed pain, including both neuropathic and nociceptive characteristics. Nociceptive pain can be further divided into either somatic pain, which relates to the musculoskeletal system, which will be mainly discussed in this thesis, and visceral pain, which is where pain originates from internal organs and can result in symptoms such as angina or gastric cramping (64). The way in which pain is classified can affect the choice of drugs as well as the way in which the condition is treated. The management of pain shall be discussed more in section 2.2.

Table 2 Disease states and pain type, duration and pattern

Disease state	**Type of pain**	**Likely duration/pattern of pain**
Angina	Nociceptive – visceral	Acute; chronic intermittent
Migraine	Nociceptive – visceral	Acute; chronic intermittent; chronic continuous
Dysmenorrhoea	Nociceptive – visceral	Acute
Gastric cramping (associated with irritable bowel syndrome)	Nociceptive – visceral	Acute; chronic intermittent; chronic continuous
Osteoarthritis	Nociceptive – somatic	Chronic continuous or chronic intermittent (ie activity induced)
Bone metastasis	Nociceptive – somatic	Persistent, continuous
Back pain	Mixed – somatic	Acute, chronic continuous or chronic intermittent (ie activity induced)
Persistent post-operative pain	Mixed – somatic	Acute, chronic continuous or chronic intermittent (ie activity induced)
Rheumatoid arthritis	Nociceptive – somatic	Acute, chronic continuous or chronic intermittent (ie activity induced)
Peripheral neuropathy	Neuropathic	Acute, chronic continuous or chronic intermittent (ie activity induced)

2.1.1.2 Assessment of pain

Pain is subjective, and thus a way to measure it objectively is necessary to assist in clinical decision making regarding the appropriateness of the pharmacological management strategies employed. There are numerous scales that can be used to assess pain severity or nature (65), including the Numerical Rating Scale (NRS), The McGill pain questionnaire and the Abbey Pain Scale. There are also assessment measures to ascertain the characteristics of the pain such as the Douleur Neuropathique 4 (DN4) or the painDETECT assessment tools to assess whether the pain is of neuropathic origin (66, 67). Pain tools have also been developed to assess pain in specific pain conditions, such as the West Ontario and McMaster Universities Osteoarthritis Index (68) and the Rheumatoid Arthritis Pain Scale (69). Pain can also be assessed by reviewing its impact on quality of life measures, such as and the Short Form-36 Bodily Pain Scale (65) or the Arthritis Impact Measurement Scales (70).

The NRS is one of the most commonly used pain assessment tools; it assesses pain by asking patients to rate their pain using a numerical scale of zero (no pain) to 10 (the worst pain they could imagine). A more comprehensive measure often used is the McGill Short Form pain assessment (71), which includes a number of pain assessments including a the Visual Analogue Scale (VAS) which assesses pain based on a patient indicating on a drawn 10cm line the level of their pain; a patient's current intensity of pain is assessed using the Present Pain Intensity Index and a number of descriptors regarding the pain characteristics are also included. Another assessment tool, often used, particularly, although not exclusively in children is the Wong-Baker FACES assessment (72), which assesses pain by showing patients faces demonstrating different levels of pain and asking which one reflects their pain. Pain can also be assessed descriptively, for example none, mild, moderate and severe. For patients who are unable to communicate their pain, other scales such as the Abbey Pain Scale (73), Pain Assessment in Advance Dementia Scale (PAINAD) (74) or the Critical-Care Pain Observation Tool (75) can be used, which assess non-verbal pain descriptors.

Self-rated pain assessments tools such as the NRS, VAS, verbal rating scale and a face scale have been demonstrated to be valid methods to detect pain intensity (76). Selecting the correct tool to use in a given situation is important. Some tools are very simple to use - for example the NRS, that captures intensity only but are simple to administer, whereas other more in depth questionnaires, such as the McGill Pain Questionnaire, provide additional information about the characteristics of pain, but require trained health care professionals to administer them. However, assessment tools are not without the problems. By far, the greatest flaw with these self-assessment tools is that there is no way to objectively quantify what the patient has reported;

this could potentially result in both under and over estimation of pain severity. Patients who are over stating their pain, may be doing so with the objective of receiving opioids for aberrant drug use, which has been noted as a concern for GPs when prescribing opioids (77). Whereas underestimation, due to patient stoicism in older patients in particular, may result in inadequately managed pain. Both of these can have poor patient outcomes. Similarly, assessment tools that are based on observation, for those patients unable to verbalise their pain, are reliant on medical staff identifying facial expression, vocalisation, changes in behaviour and body language to indicate pain. These observation tools require time to assess the patient and also knowledge about how a person would normally behave in order to make a decision regarding their pain. Overall, the assessment of pain is challenging, but necessary in order to assist in the clinical decision making process and provide the best patient care.

2.1.2 Pain pathophysiology

Acute pain is a necessary protective mechanism of the body, to prevent us from undertaking behaviours that will result in further damage (48, 78) and allow the body to heal, prevent infection and commence recovery at the injury site (3). Acute pain has an identifiable cause, and should be managed as a symptom of this other condition (4, 63). Acute pain will generally subside after the cause of the pain has been resolved or the area has healed (for example, a scar has formed or a bone has been re-aligned and the limb set in plaster).

Figure 1 represents the pain pathophysiology for acute nociceptive pain. Acute pain occurs when a noxious stimulus, something that causes or has the potential to cause tissue damage, acts on sensory receptors, known as nociceptors in the peripheral nervous system. This is a process referred to as nociception (47, 48). The signal is then transduced and encoded to an action potential which is subsequently conducted to the central nervous system (CNS) (4, 48, 63). From there, the pain signal results in second order neurone activation in the dorsal horn of the spinal cord (47). This results in the pain signal being transmitted to the thalamus, and then, via third-order neurones, the signal is transmitted to the cerebral cortex where the brain perceives the pain signal (3).

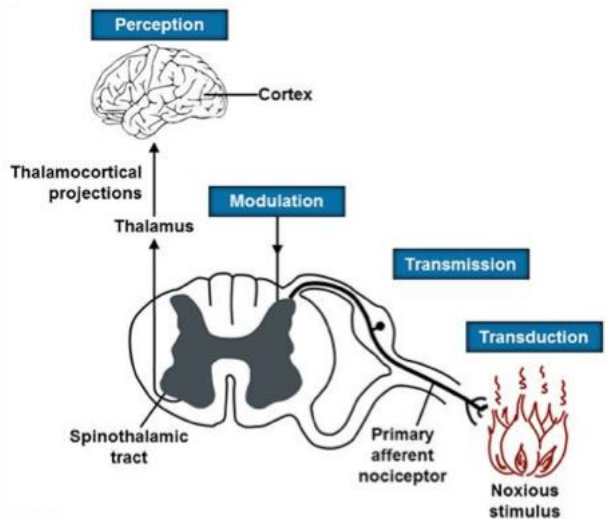

Figure 1 Nociceptive acute pain pathophysiology (79)

The stimulation of the nociceptors results in an influx of inflammatory mediators at the site of injury (49, 80) including cytokines, chemokines, and neurotrophins (3, 48). This slew of inflammatory mediators leads to the sensitisation of nociceptors, resulting in the receptors having a lower stimulation threshold and also eliciting an increased response to the noxious stimuli (3, 4, 63). Consequently, a patient may demonstrate a hypersensitivity reaction where they feel more pain from the same stimulus (hyperalgesia) and/or they can experience a lower threshold for pain, meaning they feel pain from a stimulus that would previously not have caused any pain (allodynia) (48, 63) as demonstrated in Figure 2. Generally, this sensitisation is a short-lived protective mechanism (4, 63).

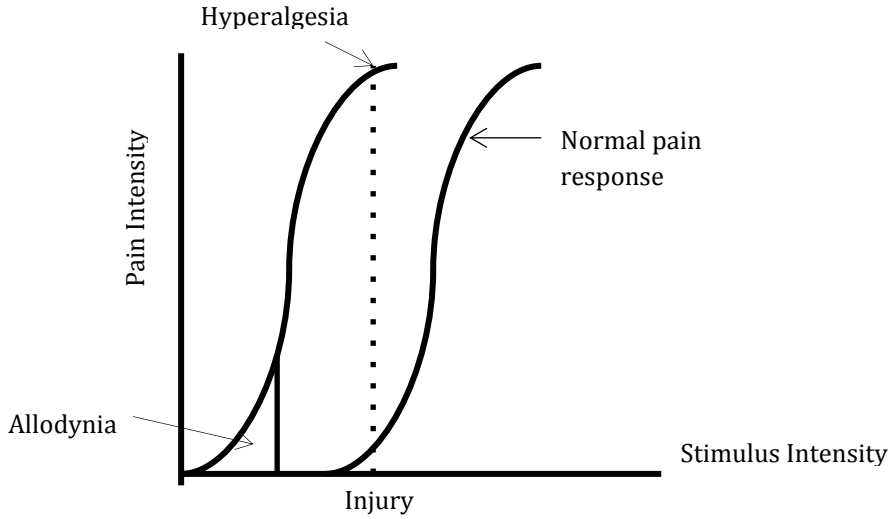

Figure 2 Pain sensitisation (79)

If the inflammation associated with pain is short in duration, then the nociceptors return to their normal function and no secondary changes occur. If, however, the sensitisation is prolonged, secondary changes can occur that increase the activation of nociceptors, increasing the number of pain signals reaching the CNS (3, 49, 80) and subsequently increasing the excitability of the dorsal root ganglia and then the dorsal horn (48, 80). This has the potential to result in peripheral sensitisation and then subsequently central sensitisation, where nociceptors in the CNS demonstrate heightened sensitivity to pain stimulus (4, 63). Prolonged acute pain and the resultant central sensitisation can cause changes to the way the CNS pathways operate, through the process of neural plasticity (3, 47) which can then result in the transition from acute to persistent or chronic pain. By definition, all cases of persistent pain start out as acute pain, one of the common causes of which are surgical procedures. This area has received significant attention and it has been identified that high levels of acute postoperative pain increases the likelihood of developing PPP (81, 82), in part due to peripheral and central sensitisation.

This transition from acute to persistent pain occurs during the subacute period. Although there is no standard definition for subacute pain, it generally describes the period following an acute pain episode, up to approximately three months, after which point in time the person would be deemed to have persistent pain (83). Despite acute pain being a precursor to persistent pain, it is inappropriate to simply regard persistent pain as acute pain that continues for a prolonged period of time. Persistent pain has a very different pathophysiology (84). For example, patients with chronic pain conditions can also have changes to endogenous pain pathways, such as diffuse noxious inhibitory controls (DNIC). DNIC is a pain pathway where one painful stimulus inhibits the pain of another pain stimulus (85, 86). Diminished function of this pathway has been associated with a number of persistent pain conditions including osteoarthritis, RA and fibromyalgia (85, 86). However, pathophysiology alone does not explain why pain transitions from being acute to chronic. A number of factors have been associated with an increased likelihood of experiencing pain and these shall be discussed more in section 2.1.3.

Previously, persistent pain was managed based on the likely underlying disease or site (87) and as a symptom of another disease. However, this strategy may be ineffective, for example, disease-modifying treatments for RA improve the underlying disease but do not necessarily improve the pain (87). In these circumstances, where the pain persists despite the initial injury or disease having improved or resolved, changes in pathophysiology result in pain persisting (88). Consequently, persistent pain is often classified as a disease state in its own right (36, 80, 89) and requires different management strategies, to that for acute pain. Further to this, the goals of management also change. In acute pain, the goal of management is reduction of pain intensity

preferably to no or minimal pain intensity; whereas the goal in persistent pain is to improve function rather as eliminating pain, which is generally unachievable (90-95) due to the underlying physiological changes.

2.1.3 Diagnosis, perception, experience and predictors of pain

Pain is a subjective and variable process, with each person experiencing pain differently (96). It is heterogeneous with different aetiologies resulting in the same symptoms as well as the same aetiology presenting with a number of different symptoms (87). This is because the stimuli are not the only determinants of the pain experienced; the perception of pain is governed by biological, psychological and social factors (Figure 3). Generally, it is thought that these factors interact and thus all aspects should be considered when managing pain. This section shall discuss the factors associated with differences in development or perception of pain.

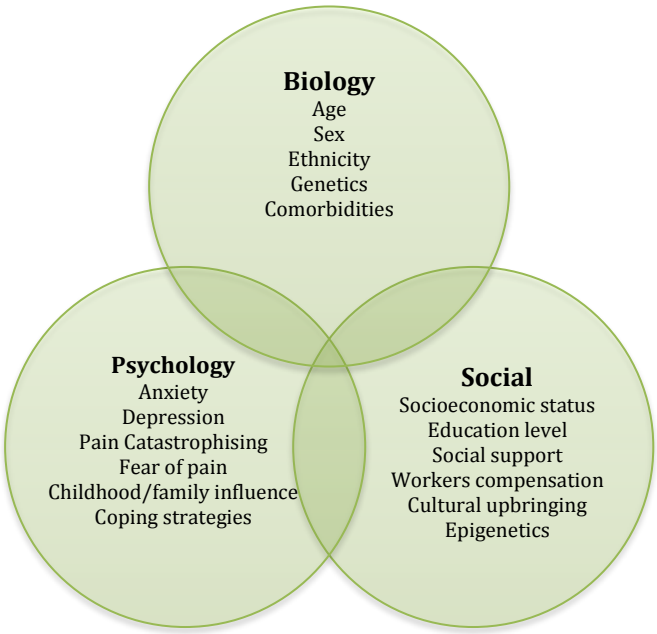

Figure 3 The biopsychosocial model of pain

2.1.3.1 Biology

An individual person's biology generally cannot be changed. Factors, such as age, sex, ethnicity and genetics influence the likelihood of an individual developing pain. These biological factors also interact with psychological and social factors and thus alone are not the sole determinant of a person being diagnosed with a pain-causing condition.

2.1.3.1.1 Age

The prevalence of persistent pain increases with age (6, 7), with people over the age of 50 years being twice as likely to be diagnosed with a pain-causing condition, than people aged less than 50 (46). This is because a number of conditions that cause pain are more likely to occur with increasing age, including osteoarthritis, fractures (often associated with falls), cancer, diabetes mellitus, stroke, post herpetic neuralgia and neurodegenerative diseases such as Parkinson's disease. The level of disability associated with persistent pain also increases with age (97). However, younger patients have been found to be at higher risk of certain types of persistent pain, including PPP (82) and pain caused by trauma (98), which is likely associated with people under the age of 65 being at greater risk of injury and trauma (99).

Age-related physiological changes affect how the elderly perceive and experience pain, including a reduced production of endogenous analgesic substances and changes in pain perception, which can complicate the presentation and diagnosis (100-105). It is important to note, however, that chronological age does not necessarily reflect a patient's QOL, level of frailty or physical function (106, 107); for this reason, patients should be assessed and treated on a case-by-case basis. Older people also demonstrate greater heterogeneity in the way they respond to medications, including analgesics (16), which is in part attributable to changes in pharmacokinetics and pharmacodynamics (108), higher number of comorbidities (109) and prescribed medications, increasing the risk of drug interactions and adverse effects (110).

2.1.3.1.2 Sex differences

Differences between the sexes in pain prevalence and severity have been well documented (111-113), with women consistently demonstrating a higher incidence of persistent pain (6, 8, 113). Some of these differences have been hypothesised to be due to variations in social and psychological conditioning between men and women (114-116). However, a number of biological factors also influence pain perception and sensitivity (117) including the influence of testosterone in-utero, the effect of oestrogen as a pain modulator in women (116) and endogenous opioid production (114, 116). Pain sensitivity also varies across a woman's menstrual cycle (118-121), as well as her lifetime, including a reduction in certain types of pain following menopause and an increase in others (116). Additionally, during active labour there is also an increase in the pain threshold, presumably as a protective mechanism (122).

2.1.3.1.3 Ethnicity

Differences have been demonstrated between ethnic groups, in relation to experimental pain. Studies have found a reduced pain tolerance for people of African-American or Hispanic descent

(123, 124) as well as a higher prevalence of persistent pain in clinical practice (125-127). Studies from New Zealand (8, 9) found the prevalence of persistent pain was lower in people of Asian and Pacific Islander descent than those from European descent; however, a different study did find they experienced greater pain intensity (128). It is unclear if these differences in pain sensitivity and prevalence are related to social, cultural, psychological or genetic differences, or an interaction of some or all of these factors (127).

2.1.3.1.4 Genetic polymorphisms

Genetic polymorphism is where individuals exhibit differences in their DNA sequence. The association of genetic factors and persistent pain has been well documented (81, 82, 129, 130). These genetic changes have been shown to affect nociception (131), pain perception (132, 133), opioid receptor expression (134) and variations in levels of catecholamine-O-methyltransferase (COMT) causing changes in pain response and susceptibility to pain conditions (133, 135). Opioid analgesic efficacy can also be reduced with certain genetic polymorphisms, including cytochrome P450 2D6 polymorphism reducing the efficacy of codeine and multi-drug resistant gene 1 (MDR1) polymorphisms reducing the efficacy of opioids (136). Other factors are also influenced by genetics, including susceptibility to pain catastrophising (137), which affects the way people think about, cope with and manage pain. In addition, other genetic polymorphisms can predispose people to certain painful conditions such as migraine (138), fibromyalgia (139) and RA (140). It has been suggested that one difference alone is probably unlikely to affect overall pain perception; however, the interaction of multiple genetic differences may result in variations in how pain is experienced (131, 132).

2.1.3.1.5 Comorbidities

Obviously pain-causing comorbidities increase the risk of patients experiencing pain. However, pre-existing persistent pain has also been associated with the development of new persistent pain conditions (81, 82, 141). The mechanism behind this is thought to be related to allodynia and hyperalgesia causing a heightened pain response. Psychological comorbidities including depression, anxiety (9, 56, 81, 82, 142-147) and substance abuse (148, 149) as well as cardiovascular disease have also been associated with persistent pain (150).

2.1.3.2 Psychological factors

The effect of one's psychology (thoughts, feelings and behaviour), on both the likelihood of developing pain and the ability to cope with pain, has been extensively researched. Anxiety, depression, pain catastrophising and stress have been associated with an increased likelihood of experiencing PPP (48). Pain, particularly persistent pain, has been found to be associated with

anxiety and depression, as well as other psychological conditions including post-traumatic stress disorder (9, 56, 81, 82, 142-147) with some studies finding that more than one psychological condition increases the risk of pain related disability (146). In addition, a number of studies have also found an association between psychological comorbidities and the number of pain sites (151, 152).

2.1.3.2.1 Depression

A number of studies (56, 145, 147, 153-155) have found an association between persistent pain and depression; with some studies also finding an association with acute pain (155, 156). A number of hypotheses have been proposed to explain the relationship between pain and depression (157). Firstly, that chronic pain decreases QOL and physical function, thus resulting in depression; secondly, that depression comes first and increases sensitisation to pain; or thirdly, that it is a bi-directional relationship, meaning that having depression can both cause and be caused by chronic pain (157), which is not unreasonable as they share a number of similar pathways in the body (145, 158). Recent evidence has also indicated that opioids may increase the risk of depression; this does not appear to be dose-dependent (159).

2.1.3.2.2 Anxiety

Anxiety and pain may also have a bi-directional relationship. Patients who are anxious are more likely to report pain and have a greater number of painful sites than those patients without anxiety (146, 147, 160). This may also be associated with the patient's coping strategies, with patients who are anxious or fearful of pain more likely to use avoidance strategies to prevent further pain and damage, which conversely results in greater levels of disability (161). Lower levels of self-efficacy (the ability to continue "normal" behaviour despite the presence of pain) have been associated with increased levels of anxiety and increased levels of disability (162). Preoperative anxiety has also been associated with an increased risk of higher levels of postoperative pain and increased risk of PPP (82, 163).

2.1.3.2.3 Pain catastrophising and fear of pain

Pain catastrophising is defined as "an exaggerated negative mental set brought to bear during actual or anticipated painful experience" (164). Pain catastrophising has been found to increase pain intensity and disability associated with pain, as well as increase the risk of developing persistent pain (81, 82, 165-170). Fear of pain is closely related to pain catastrophising, with fear affecting the severity of the pain experienced (144). One study (171) found that children's recollection of pain intensity was a more accurate indicator of pain intensity reported, demonstrating the effect that memory has on the anticipation and actual experience of

subsequent painful events. Avoidance behaviour due to fear of pain has also been found to be associated with an increased level of pain and disability (172, 173). Passive coping strategies, such as praying or hoping pain will get better, has also been associated with increased pain intensity and disability (174, 175). In comparison, active or enhanced coping strategies for pain have been associated with reduced disability, but not reduced pain intensity (168, 176). Acceptance of pain and the associated limitations has also been associated with lower pain intensity and lower emotional distress (177). These factors demonstrate the significant impact that the way one thinks about pain has on the ability to effectively cope with and manage in life with pain.

2.1.3.2.4 Childhood

Sexual and physical abuse during childhood has been found to be associated with persistent pain and disability in a number of studies (178-185). The majority of studies have evaluated the effect of abuse on women, although some studies have included men (181, 186). This area of research is complicated by the sensitive nature of sexual and physical abuse, reducing the likelihood of large population-based studies. Additionally, traumatic events during childhood, including the death of a mother, hospitalisation associated with a traumatic event (e.g. car accident), being placed in care or experiencing financial hardship have been found to increase the likelihood of developing persistent pain (187).

A number of studies have suggested that the relationship between a child and their parents can also affect the likelihood of developing a persistent pain condition and how well the patient copes with a persistent pain condition (162). It has been hypothesised that a child's relationship with their parents can also indirectly influence the development of persistent pain conditions in later life, by affecting their subsequent relationships with others (including their parents and romantic relationships) (162, 188-190).

2.1.3.3 Social and environmental factors

A number of social and environment factors can influence pain development, associated disability, efficacy of pain management or coping strategies; and include cultural differences (191) and environmental factors (192). People who are part of a lower socio-economic group (6-8, 125, 126, 193) or have lower educational levels (6, 7) are more likely to experience pain and have higher levels of disability associated with that pain. Some research also indicates that when people receive compensation for a work place injury they have a slower return to work, than those who do not (194, 195). Perceived social support has been found to improve the ability to function when experiencing persistent pain (168, 196). Epigenetic changes have also been

identified, where the environment in which one lives affects the genetic makeup (197, 198), resulting in changes to the way pain is experienced.

2.1.3.4 Factors predicting the chronicity of pain

"All chronic pain was once acute, but not all acute pain becomes chronic" (199). As the above section has described, there are numerous factors associated with pain and pain-causing conditions, and it is likely that an interaction between multiple factors increases the likelihood of this transition occurring. In terms of identifying factors increasing the likelihood of pain transitioning from acute to persistent, most attention has been focused on the postoperative setting. Surgery presents a unique area to study where the cause of acute pain is known, often amenable to a greater degree of control and generally (although not always if surgery is related to persistent pain) does not exist prior to the surgical incision. Factors that have been identified as increasing the risk of PPP include a number of the aspects discussed above, such as pre-existing pain, younger age, female, pre-operative anxiety, depression, pain catastrophising, low income, low education level and poor self-rated health (81, 82, 199-203). In addition, a number of other surgical related factors have been identified including, type or surgery, longer duration of surgery, low volume surgical unit, unrelieved postoperative pain, high postoperative analgesia consumption, stress, late return to work, infection, bleeding, compartment syndrome and organ rupture (81, 82, 199-203). A small number of studies have also evaluated pain following discharge after surgery, which may also predict the chronicity of pain (204-208).

The chronicity of back pain has also been extensively researched. Studies have found that up to 20% of patients who suffer an acute back injury will still be suffering from pain one year later (209). A systematic review of the literature found a number of factors to be associated with an increased likelihood to transition to persistent lower back pain including: maladaptive behaviour, functional impairment, psychological vulnerability, poor health status and financial compensation (209). Age, gender, smoking status, occupation dissatisfaction, high physical demand jobs and education level, however, have not been found to be consistently associated with the development of persistent back pain (209).

The persistence of neuropathic pain has also been researched, with anxiety, depression, pain catastrophising and age all considered to predict persistent neuropathic pain by a panel of experts (210). A systematic review found that fear of movement, passive coping strategies, psychological vulnerability, acute pain and increased body weight also increased the risk of pain persisting (211). Neuralgia following herpes zoster infection has also been found to be more common in patients who are older, male, smokers, experienced higher levels of acute pain,

experienced a shorter duration but more severe rash, those who did not use antiviral medication and those with a poorer health status prior to the infection (211, 212).

In summary, although studies have found various factors to be associated with the way a person experiences pain or the likelihood of them developing a persistent pain condition, these factors often overlap. This allows for profiling of those people likely to experience pain conditions and may, in the future, allow for more targeted interventions to reduce the likelihood of patients developing persistent pain conditions. Nonetheless, further research is needed as studies have provided conflicting results, often use variable definitions of persistent pain and including variable patient data. Consequently, large-scale prospective studies would be very beneficial to aiding in the development of assessment tools for predicting those most at risk for persistent pain conditions.

2.2 The pharmacological management of pain

The field of pain management and the role of pain physicians are relatively new in medicine. The treatment of persistent pain as part of a multidisciplinary team only commenced in the 1950s with Dr John Bonica opening the first multidisciplinary pain centre (213, 214). The first textbook regarding the management of pain was published in 1953 (214).

Pain is frequently managed using pharmacological treatment options. Numerous agents have analgesic properties and these include paracetamol, opioids, non-steroidal anti-inflammatory drugs (NSAIDs) including the cyclooxygenase (COX)-2 inhibitors, antidepressants, antiepileptic drugs (AEDs), corticosteroids and local anaesthetics. However, it is important to acknowledge the role that non-pharmacological strategies play in the management of pain, particularly persistent pain. These strategies include cognitive behavioural therapy (CBT), physiotherapy, acupuncture, osteopathy, transcutaneous electrical nerve stimulation (TENS), heat therapy, exercise and other forms of mechanical manipulation (215, 216). In addition, patients frequently employ complementary and alternative therapies to aid in managing pain, especially where pain is due to rheumatological conditions; these can include fish oil, glucosamine and chondroitin. The use of non-pharmacological management strategies or complementary or alternative therapies, although frequently employed by patients and health care providers, is beyond the scope of this literature review, and will not be discussed further in this review.

Decisions regarding pharmacological treatment options for pain are often chosen depending on the aetiology and likely duration of pain-related episodes. If pain is associated with an underlying condition such as autoimmune conditions, disease-modifying therapy may also be included in the

management strategies to reduce and prevent further damage or inflammation. Similarly, if a patient suffers from visceral pain, treating and managing the underlying condition rather than relying on analgesics, is the mainstay of therapy, such as antispasmodics for gastric pain or glyceryl trinitrate for angina-related pain. The management of underlying diseases is beyond the scope of this review, which will focus primarily on medications that exert analgesic properties.

General guidance for the management of persistent pain suggests commencing analgesics in a step-wise fashion, starting with a non-opioid analgesic and building on this if pain is inadequately managed (16, 108, 217-220) (Figure 4). Medications should be commenced at a low dose and slowly titrated upwards to an effect, noting that adverse events can occur at doses below the level where patients receive adequate analgesic benefit (16, 108, 221). If a patient's pain is inadequately managed using a non-opioid analgesic alone then opioid analgesics should be added to the patient's therapy (108, 217, 222). This multimodal management of pain, where a combination of different classes of drugs with complementary modes of action, are used concomitantly (e.g. an opioid plus paracetamol, an NSAID, or an adjuvant analgesic drug) is recommended for both acute and persistent pain (48, 223-225). This combination therapy may improve pain management and can also have an opioid-sparing effect (16, 108).

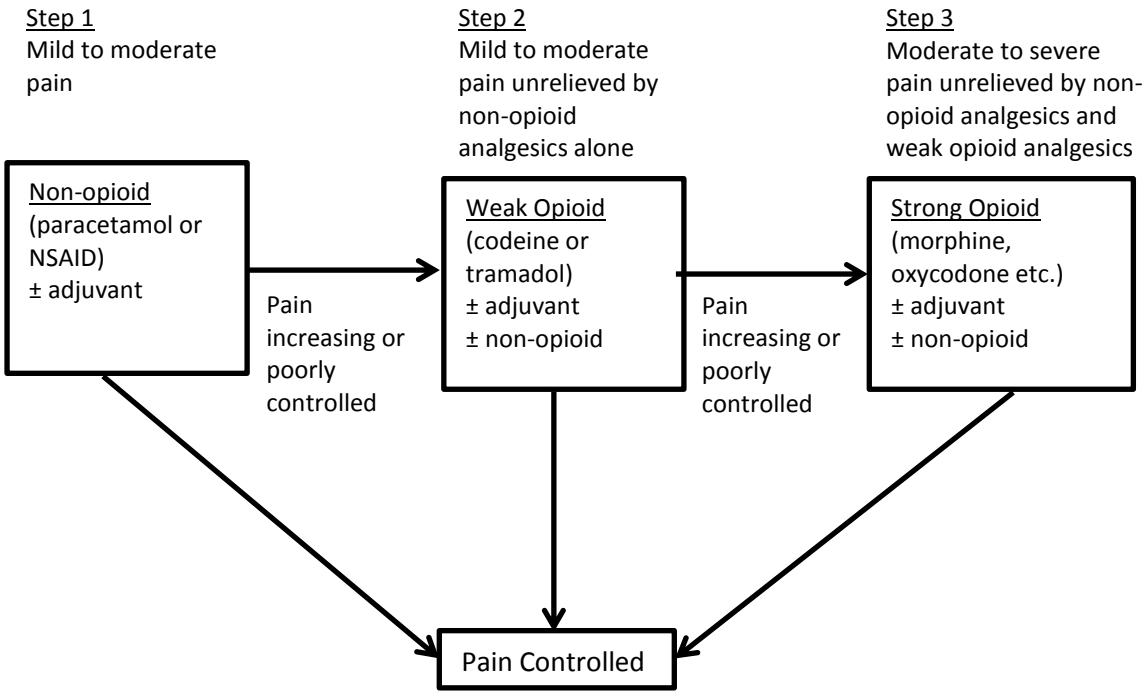

Figure 4 World Health Organisation (WHO) Pain Ladder (217, 226)

However, pain management must also be tailored to the severity and duration of pain (108); for example, commencing paracetamol (a non-opioid analgesic used for the management of mild to moderate pain) for severe pain, without other pharmacological management strategies is unlikely to be effective or appropriate. Similarly, commencing a long-acting opioid for severe infrequent intermittent pain is less suitable than a short-acting, fast-onset agent.

Patient factors and the needs of certain patient populations also should be considered before prescribing analgesics. For example, older patients, particularly those who are frail, tend to have multiple comorbidities and multiple medications, increasing the likelihood of drug-drug or drug-disease interactions. In addition, these patients tend to have a number of other factors affecting drug selection and dosing, including altered pharmacokinetics and pharmacodynamics as a consequence of physiological changes with ageing, and are at increased risk of adverse events (108, 227, 228). Patients with a history of substance or alcohol abuse, depression or anxiety are also more likely to experience aberrant drug use associated with opioid analgesics (148, 154, 229), and further harm minimisations strategies and non-pharmacological treatment strategies should be employed (12, 15, 16, 219, 230).

Evidence for the use of most analgesics, even prescription pharmaceutical agents, are often lacking in level one, randomised controlled trials evaluating long-term treatment outcomes (89, 231). In addition, as with many conditions, there are also a lack of randomised controlled trials or head to head trials, of sufficient duration which include patients with multiple comorbidities, and frail or elderly patients to be able to adequately inform treatment practices (228, 231). Trials evaluating the effect of analgesics on persistent pain often last weeks or months, rather than years (18, 231, 232). Consequently, long-term efficacy, as well as adverse effect profiles, are often not identified and the actual risks in those population groups excluded from trials, such as the frail, elderly, those with a substance abuse history or those with comorbidities are relatively unknown.

Numerous guidelines exist in different countries, for various pain-causing aetiologies and different patient groups (16, 108, 219, 222, 228, 233-237) to guide the management of persistent pain. However, the vast majority of these guidelines are generally laborious to read and often provide minimal practical advice to clinicians about drug choice, dose or co-prescribed therapies. A significant issue with the production of guidelines for chronic pain is the dearth of published literature to evaluate outcomes and thus rely on expert opinion. In addition, most trials focus on a reduction in pain scores rather than an improvement in physical functioning; for this reason new guidelines have been developed describing six areas that should be evaluated in clinical trials about pain (238). Noting the diversity in the guidelines in this area, the WHO has commenced

writing evidence-based guidelines for the treatment of chronic pain in adults (239). It is likely to be a number of years before these guidelines are publically available and accepted by the medical community. Table 3 summarises the most commonly used pharmacological treatment options for the management of pain. These are discussed, in turn, in further detail below.

Table 3 The primary pharmacological treatment options for the management of pain (220, 240)

Drug class	**Pain Type**	**Pain Duration**	**Pain Severity**	**Add on/ monotherapy**
Paracetamol	Nociceptive and mixed	Acute and persistent	Mild-severe	Add on and monotherapy
NSAIDs	nociceptive and mixed	Acute and persistent	Mild-severe	Add on and monotherapy
Opioids	Nociceptive and mixed	Acute and persistent	Moderate-severe	Add on
Gabapentinoids	Neuropathic and mixed	Acute and persistent	Mild-severe	Add on and monotherapy
AEDs	Neuropathic and mixed	Acute and persistent	Mild-severe	Add on and monotherapy
Antidepressants	Neuropathic and mixed	Acute and persistent	Mild-severe	Add on and monotherapy
Nerve blocks	Nociceptive, neuropathic and mixed	Acute (primarily) and persistent (refractory pain)	Moderate-severe	Add on

NSAIDS: non-steroidal anti-inflammatories; AED: anti-epileptic drugs

2.2.1 Assessment of analgesic efficacy

As noted previously, the evidence used to support the development of guidelines often relies on expert opinion as the clinical trials undertaken to assess the efficacy of analgesics are often methodologically poor, use variable trial methodology, drug dose, route of administration and are too short to be able to assess the true safety and efficacy of drugs in persistent pain; which make comparisons between studies extremely challenging. It is for these reasons that systematic literature reviews are often unable to conclude an effect size from the medications. In addition, trials will frequently exclude patient populations such as elderly, frail and those with a history of substance abuse, which makes generalising the effect size to these populations nearly impossible. There are some published works such as the Oxford League table (241) which documents the number needed to treat for a 50% reduction from baseline with a stat dosing of an analgesic, which is useful in the acute, but not persistent, pain setting. Nonetheless, these include only studies that compare the active treatment to placebo rather than another active comparator, and consequently cannot take into consideration the synergistic benefit of multimodal analgesia that is often used in the post-operative setting, making the applicability of this data to actual clinical practice still uncertain.

Further complicating the assessments of effect size is then determining what effect is clinically meaningful. Some studies have found that a reduction of 30% or a reduction of two points on the NRS is clinically significant and corresponds to a clinically significant improvement (242). However, as noted previously, there are many assessment tools that can be used and how to amalgamate these scores in meta-analyses to identify an effect size is also challenging. Furthermore, a reduction of pain intensity as measured on a NRS is patient-dependent. A number of studies have found that a reduction in pain intensity is not linear in its response to clinical significance, with greater pain intensity scores requiring a greater reduction in intensity to be clinically relevant (243, 244). This means that the baseline score is required rather than aggregate scores to ascertain a clinically significant pain reduction. It is in part for this reason that there is also increasing recognition of the need to assess quality of life improvements rather than reduction in pain intensity when managing persistent pain patients (90-95), although for acute pain, a reduction in pain intensity is still the primary goal.

2.2.2 Non opioid analgesics

2.2.2.1 Paracetamol effectiveness

Paracetamol (or acetaminophen) can be used for mild pain as monotherapy, and in combination with other analgesics for the management of moderate to severe pain. The mode of action of paracetamol is not fully understood. A number of mechanisms have been proposed, including inhibition of prostaglandin H2 synthesis via COX-2, as well as the activation of descending serotonergic pathways (220, 245-247). Paracetamol can be administered via oral, intravenous (IV) or rectal routes (245).

Paracetamol is one of the most common medications used around the world and can be used from infancy to death (246). It is generally recommended as baseline therapy for both acute and persistent pain (16, 108, 240, 248). Following surgery or in conditions that cause persistent pain (that is not intermittent in nature) generally paracetamol should be taken regularly at the maximum tolerated dose (preferably four grams (g) per 24 hours for most adults). If pain is inadequately controlled by paracetamol alone, then paracetamol should be continued at the maximum tolerated dose and other medications should be used concomitantly (16, 219).

Paracetamol has been used extensively in acute pain management with good effect in both stat dosing and repeated dosing across a range of different types of acute pain (48, 245, 248-254). IV paracetamol has been found to be an effective analgesic following surgery as well as reducing overall opioid consumption (48, 255, 256) although the optimal dosage range and the extent to which it is opioid-sparing require further investigation (245). Not all studies evaluating

paracetamol have demonstrated analgesic benefit (257), with others indicating no difference in recovery speed compared to placebo (258).

Paracetamol in some studies appears to not be as effective as NSAIDs; however, it is better tolerated and is subject to fewer contraindications, and can therefore be used in a wider range of patients (246). A number of studies have also suggested that paracetamol in combination with an NSAID may be more effective than the individual components alone (48, 259-262). However, a recent study found that paracetamol, an NSAID and an adjuvant (gabapentin) was not superior to two non-opioid analgesics (256). Additional research is required to determine the optimal multimodal analgesic regimens for acute pain and the role of paracetamol in these.

Paracetamol has been used to good effective for persistent pain conditions (253). However, as with most analgesics, the evidence to support its use in persistent pain is variable and trial durations are short (263-265). A recent meta-analysis (19) found that paracetamol was slightly more effective than placebo in the management of osteoarthritis of the knee and hip and as effective as placebo for lower back pain. It is important to note that the placebo effect has a considerable influence in the management of pain (266). As placebos are unavailable in clinical practice, the effect of paracetamol over no treatment is likely to result in an improvement in pain management over no treatment. Additionally, there were some flaws in this meta-analysis, namely the use of multiple arms of a study with different doses of paracetamol (ranging it from 500 milligram (mg) when required to 4g regularly). The effect of these doses is not comparable and thus it is unreasonable for them to be assessed together and may contribute to an underestimation of the effect of paracetamol. A network met-analysis (267) was conducted comparing different doses of paracetamol This study found that paracetamol, as well as other NSAIDs were superior to placebo for the management of osteoarthritis pain in relation to pooled effect size and physical function. However, the effect size was small (4mm on a 100mm visual analogue scale) for doses of less than 2g per day, although the effect size was greater at doses exceeding 2g per day, indicating there may be more benefit at higher doses.

2.2.2.2 Paracetamol safety

Adverse events are uncommon with paracetamol (within the recommended maximum dosage 4g daily) however, the safety and efficacy profile of paracetamol is increasingly being questioned (20). Dosage adjustment is normally not required unless the person weighs less than 50kg or they are at high risk of liver failure, where a maximum daily dose of 2g is recommended (268-270). It was noted in a recent meta-analysis that the adverse event profile associated with paracetamol demonstrated no statistically significant difference to that of placebo, with the

exception that liver enzymes were more likely to be elevated in those taking paracetamol (19). However, a short course of therapeutic paracetamol did not result in increased liver function values or risk of toxicity in the frail elderly (271). Thus the clinical relevance of asymptomatic, elevated liver enzymes is unclear. In addition to raised liver function tests, a recent systematic review of observational studies was published which suggested paracetamol may increase the risk of a cardiovascular events, kidney impairment and gastrointestinal bleeding (270). Despite this finding, there remains a far greater body of evidence suggesting such harms are more prevalent with NSAIDs and, that on the basis of this current knowledge, paracetamol is generally considered to be a safer option at standard therapeutic doses (264).

There is limited published evidence to determine the effect of frailty or age-related hepatic decline on paracetamol metabolism or the risk of overdose (272). Additionally, whilst the draft version of British guidelines for osteoarthritis management suggested paracetamol may not be a safe choice in elderly patients, this recommendation was not included in the final report (237) and paracetamol is likely safer than the alternative options (264). As those patients most likely to use paracetamol are almost universally excluded from clinical trials, further research is needed to determine the adverse effect profile of paracetamol when taken chronically in these populations.

The most concerning adverse event related to paracetamol is the risk of overdose. Paracetamol toxicity is the leading cause of acute liver failure in the United States of America and Europe, with approximately 50% of these cases as a result of an unintentional overdose (269). Overdose of paracetamol can result in hepatotoxicity mediated through the production of a reactive metabolite, *N-acetyl-p-benzo*-quinone imine (NAPQI) (269). Generally, NAPQI will be metabolised to a non-toxic metabolite by glutathione. However, if there is a deficiency of glutathione, or an overdose of paracetamol overwhelms hepatic capacity to safely detoxify NAPQI, there is potential for liver toxicity, the outcome of which is the requirement of a liver transplant or death (269).

In addition to intentional overdose, patients may also unwittingly take excessive amounts of paracetamol. Common reasons implicated in accidental overdose are: if pain is unrelieved with standard doses, or patients take multiple paracetamol containing products (particularly in combination with a narcotic) (273, 274). This increase in overdose rates led the United States of America's Food and Drug Administration (FDA) to release a statement suggesting prescribers avoid using products containing more than 325mg of paracetamol in combination with a narcotic (275). Significant care needs to be taken around the prescribing of multiple paracetamol

containing products and subsequent counselling about the maximum dosages of paracetamol to reduce the risk of unintentional overdose.

2.2.2.3 NSAID effectiveness

NSAIDs can be used for mild to moderate pain as monotherapy, and in combination with other analgesics for the management of pain. NSAIDs act by preventing the synthesis of prostaglandins through the inhibition of COX 1 and COX 2; inhibition of COX2 results in a reduction in inflammation and subsequently pain (220). There are many NSAIDs available, including non-selective NSAIDs (such as aspirin, diclofenac, ibuprofen and indomethacin) and COX-2 selective NSAIDs (celecoxib, etoricoxib, meloxicam, parecoxib). There is some evidence to suggest that the different NSAIDs vary in efficacy, with etoricoxib being most effective, followed by ibuprofen 600-800mg, ketorolac and diclofenac 100mg (241). It is important to note, however, these are determined against placebo and the efficacy in different medical conditions, or in combination with other analgesics may vary (276).

The evidence to support the use of NSAIDs in acute pain is significant (48, 276) although trial quality is lacking (277-281). A number of recent Cochrane reviews have evaluated the efficacy of NSAIDs in a number of conditions including acute postoperative pain (48), acute gout (280), dysmenorrhoea (281), acute back pain (279), strain, sprain or bruise (277) and have generally found to be supportive of NSAID use. However, as with other areas of research, the benefit of NSAIDs is not consistent; for example, although parecoxib has been found to be effective following some surgical procedures (257) other studies found that it does not result in a reduced intensity of acute pain (282). Other patient and condition related factors likely play a role in the efficacy of the different NSAIDs.

There is evidence to support the use of NSAIDs for some chronic pain conditions such as spondyloarthritis (283), inflammatory arthritis (284) and chronic lower back pain (279). However there is also mounting evidence that in conditions not traditionally considered to be inflammatory, namely osteoarthritis, patients have a preference for NSAIDs finding them more effective the paracetamol (264, 276). Currently, the evidence to support the use of NSAIDs in neuropathic pain conditions is lacking (278).

2.2.2.4 NSAID safety

NSAIDs have a number of side effects with both acute and chronic use. They have a worse side effect profile than paracetamol (264) and for this reason it is recommended to use paracetamol preferentially (285). If NSAIDs are required, they are recommended to be used at the lowest effective dose for the shortest period of time (285), which is problematic in persistent pain

conditions where regular dosing is required. Numerous studies have reported that NSAIDs, both selective and non-selective, are associated with cardiovascular harms and the Therapeutic Goods Administration (TGA) (286) recently advised that NSAIDs should not be used in patients with cardiovascular disease or significant renal or liver impairment.

Whilst many of the potential adverse effects are common to all NSAIDs, there is some variation in the specific adverse effect profile of the different NSAIDs (285, 287, 288). Gastrointestinal irritation is common with NSAIDs and with prolonged use can cause gastrointestinal ulcers and subsequent gastrointestinal bleeding (288). COX-2 selective NSAIDs are likely to cause less gastric irritation than non-selective agents; however the co-administration of gastric protective agents (such as proton pump inhibitors) with non-selective NSAIDs also reduces the incidence of gastrointestinal ulcers (288). Similarly, there appears to be less risk associated with naproxen than other NSAIDs in relation to the risk of cardiovascular events (285, 289).

Due to the side effect profile of NSAIDs, guidelines for elderly or frail patients recommend avoiding them (16, 108, 221) and topical NSAIDs are preferred (289). However, if an oral NSAID is required, it is recommended in the elderly to use ibuprofen or naproxen in preference to other NSAIDs, if there is no history of heart failure and the patient has sufficient renal function (289). Some studies (290, 291) have suggested that NSAIDs may be safer than opioids in the elderly, although there were a number of confounding aspects, including the lack of recording of use of over-the-counter NSAIDs in the opioid group, which make the results difficult to interpret (292). Based on the safety profile of NSAIDs, guidelines generally recommend low dose opioids to be considered a more suitable add-on therapy to paracetamol than NSAIDs (16, 108) if paracetamol alone is not adequately controlling pain in elderly or frail patients.

2.2.3 Opioid analgesics

Pharmacological opioids mimic endogenous opioids, such as beta-endorphins and encephalin, that act on μ receptors in the dorsal horn of the spinal cord and periaqueductal grey in the brain (220, 293, 294) to exert their analgesic effect. Opioids should not be used for the management of mild pain, but are frequently used in the management of moderate to severe pain (48). Some opioids, namely tapentadol and tramadol, have an additional mode of action involving inhibition of neuronal reuptake of noradrenaline and serotonin. These effects result in more noradrenaline being available in descending pathways which attenuates pronociceptive receptor-driven ascending signals, further reducing pain (15). Potentially, tapentadol and serotonin and noradrenalin reuptake inhibitors (SNRIs), such as duloxetine also affect DNIC function and may increase DNIC function and subsequently improve persistent pain conditions (295, 296).

Some opioids are indicated only for use during surgical induction or maintenance of anaesthesia (remifentanil; alfentanil) and some (fentanyl; morphine) can be used intravenously during surgery as well as well as via other routes (transdermal patch, intranasal spray and orally) for acute or persistent pain (220). Opioids have different levels of potency and thus are often categorised as weak or strong opioids (297). Conversion tables are available to determine equi-effective doses (298-301). However variations in the patients' pharmacodynamics and pharmacokinetics may affect the equi-effective dose in clinical practice. For this reason, opioid switching due to individual patient factors may allow for improved analgesic effect without the need for an increased (equivalent) dose or reduced adverse events profile (48, 301-303).

2.2.3.1 Opioid Effectiveness

Morphine and its derivatives have been used as analgesics for hundreds of years (304). There is significant evidence to demonstrate the efficacy of opioids for the management of moderate to severe acute pain when given orally, IV, intramuscularly, or epidurally, as well as transdermally (48, 305-309). A range of opioids are used in the management of acute pain; however, there does not appear to be one opioid that is generally more effective than others, yet patient variability may mean that one patient responds better to one opioid over another one (48).

The evidence to support the use of opioids for persistent pain however is poor (94). Despite this, opioid analgesics are increasingly prescribed for the management of persistent pain, demonstrated by the dramatic increase in their use (21-25) and treatment duration (22, 27). The trials evaluating opioids are often methodologically poor (94) with trial durations being relatively short (18) with limited patient outcome data (89). There are also only a limited number of studies evaluating changes in the pharmacokinetics and pharmacodynamics of opioids associated with frailty and opioid use (310). A recent meta-analysis of opioids (303) concluded that there was insufficient evidence to determine if long-term opioids were effective at improving pain scores and physical functioning. Additionally, this review found that there was significant evidence of dose-dependent risks associated with the use of opioids, which will be discussed further in Section 2.2.3.2.

Nevertheless, persistent pain guidelines do universally recommend the use of opioids for moderate to severe pain that is not adequately managed with non-opioid analgesics (311). Opioid analgesics are not recommended as first-line treatment or in isolation of other pharmacological and non-pharmacological treatment options (297, 312, 313). Generally, it is recommended that opioids are used as an add-on to non-opioid analgesics, particularly paracetamol (108, 217, 222).

There does not appear to be one opioid that should be used in preference to another (222, 303) with the exception of fentanyl and methadone which should not be commenced if the patient is opioid naïve (303, 314) due to the risk of toxicity. Most guidelines recommend commencing on a low dose and titrating up to effect (92, 108, 222, 297, 315). Sustained-release preparations are preferred for persistent pain conditions (222, 297, 312, 316); and parenteral opioids should be avoided in all persistent pain conditions (297, 316). Opioids should be tapered and ceased if there is no improvement in the patient's symptoms after a trial period (normally lasting 4-8 weeks) with appropriate dose titration or if the patient choses to withdraw treatment or the pain has resolved (92, 222, 297, 312). The recommended maximum daily oral morphine equivalent (MEQ/d) dose varies from 100-120mg (Australia) (94, 312), 120mg (United States of America) (317), 120-180mg (United Kingdom) (297), to 200mg (Canada) (92).

Theoretically, all opioids may be equally safe and effective for older or frail persons; however, due to interpatient variability opioid rotation or switching may result in better tolerability or efficacy for individual patients (222, 297). The use of weak opioids, including codeine and tramadol, generally results in similar adverse event profiles but less efficacy than their stronger counterparts and thus are often not recommended (108). Van Ojik and her colleagues (228) concluded there was little evidence of the effectiveness of opioids in the treatment of chronic pain in the frail elderly, with the following options having the most evidence to support their use in these individuals: buprenorphine, fentanyl, hydromorphone, morphine and oxycodone. The most recent update of the Beers criteria, which makes recommendations about medications that should be avoided and medications that should be used preferentially in the elderly, has recommended tramadol, oxycodone or morphine, in combination with paracetamol as most suitable for elderly patients (289).

2.2.3.2 Safety of opioids

In line with the increasing use of opioids for persistent pain, there has been a trend towards increasing rates of deaths associated with opioid analgesic use (27-32), proportional to the dose being used (27, 318). However, accidental overdose can occur even at doses within the recommended range (28, 232, 319) particularly in combination with alcohol or benzodiazepines (30). In addition, another concern regarding opioids is the risk of addiction in patients taking long-term opioids. The true rate of addiction is unclear, with one literature review (320) estimating between 0-50% of those taking opioids were addicted, however they noted the definitions and methods of determining addiction were variable. A Cochrane Review (321) however identified in well selected candidates for opioid treatment, where there was no history

of substance abuse the risk of addiction was minimal. Currently the true rate of addiction is unknown and requires further prospective trials to identify the true risk.

Side effects are very common with opioids, with approximately 80% of patients experiencing at least one adverse event (297) and patients more likely to cease taking opioids due to side effects compared to placebo (322). The most commonly report adverse events associated with opioids are nausea, respiratory depression, constipation, pruritus and drowsiness or sedation (220, 297). Some side effects associated with opioids are dose-dependent such as respiratory depression and sedation; however, others, particularly constipation are not (48). Similarly, some side effects are transient or improve with time, such as sedation, whereas others do not, such as constipation that persists throughout treatment.

In addition to the common adverse events listed above, a number of endocrine abnormalities have been identified with the long-term use of opioids, including hypogonadism (323-325) and increased risk of fractures and falls (326-329). Opioids have also been implicated in affecting the immune system (330), including depleting lymphocytes in mice implanted with morphine pellets (331). Further to this, certain opioids, primarily morphine, may also increase the likelihood of cancer metastases or recurrence; currently, further research is being conducted in this area to understand potential mechanisms behind this and which, if any opioids, are implicated (332). Clinical trial durations reviewing the safety and efficacy of opioids, as noted previously, are short. This prevents the incidence of these less common adverse events to be categorised.

Nonetheless, opioids have a significant number of adverse events and should only be used when management with non-opioid analgesics has been optimised and the lowest effective dose should be used. If opioids are found to not improve physical functioning of the patient they should be discontinued, due to the risk of adverse events.

There appears to be limited difference between the side effect profiles of the available opioids, although some variations exists (222, 297). Although, switching to an alternative opioid can improve side effects for some patients (222, 297). Some opioids, namely tapentadol, tramadol and methadone, have a slightly different side effect profile compared to other opioids. Given the serotonergic effects of tramadol and tapentadol, they have the potential to cause serotonin toxicity or serotonin syndrome, especially when combined with other serotonergic drugs such as antidepressants (333), in addition to the typical opioid-related side effects. This can be a limitation to their use, given the high concurrent rates of depression in patients with persistent pain (145). Methadone, which is generally reserved for refractory pain, has highly variable

pharmacokinetics (334) and has demonstrated an increased risk of death associated with its use (335), and other opioids should be used preferentially.

2.2.3 Adjuvants

Adjuvant medications are those that are not specifically designed as analgesics, and are used primarily for other indications; however, for some disease states they demonstrate analgesic effects (336). The different types of adjuvants used in the management of acute and persistent pain include antidepressants, AEDs, N-Methyl-D-Aspartate (NMDA) antagonists, alpha-2 andrenergic agonists and local anaesthetics (336). In addition, there are a number of adjuvants that are used to manage bone pain associated with metastatic disease, including corticosteroids, calcitonin and bisphosphonates (336). However, as the focus of this review is non-cancer related pain, these bone pain specific adjuvants will not be discussed further. It is recommended, as with all medications, to use the medications with the best risk-benefit profile, commencing with one agent at a time and starting at low doses and titrating to effect (336).

2.2.3.1 Adjuvant Effectiveness

AEDs, particularly the gabapentinoids (pregabalin and gabapentin), are frequently employed in the management of neuropathic pain, and also perioperative pain management. Gabapentin and pregabalin have been found to be effective for the management of neuropathic pain, can reduce opioid requirements following surgery and reduce opioid related adverse events (48, 337-341). A systematic review of the effect of pregabalin and gabapentin on the incidence of PPP showed a statistically significant reduction in the development of PPP in those taking a gabapentinoid (342), although this study did not include unpubished studies that potentially may bias the results, a reanalysis using unpublished results demonstrated no statistical difference (343). However, a more recent study did not find that pregabalin improved pain following traumatic nerve injury, including that caused by surgery (344). Consequently, the long-term benefit of gabapentinoids following surgery is currently unclear. Pregabalin has also been found to be effective in the management of pain associated with diabetic neuropathy (48). Whilst the gabapentinoids are the AEDs most often used in pain management, other AEDs such as carbamazepine may have a role in some patients, in particular those with trigeminal neuralgia (48).

Antidepressants have been found to be beneficial in a number of persistent pain conditions, particularly neuropathic pain (48, 336, 338, 345). However, the evidence to support the use of these medications in acute pain management are generally based on extrapolation of trials in persistent pain (48). Tricyclic antidepressants (TCAs) have been found to be effective in the

management of neuropathic pain, fibromyalgia, and headaches (48). Duloxetine, an SNRI, is effective for management of pain associated with diabetic neuropathy and fibromyalgia (48, 108, 338, 346). Venlafaxine, another SNRI, has also been found to be effective in the management of persistent pain in patients with depression (347, 348), post-surgical pain (349, 350) and diabetic neuropathy (350). Studies have been conducted evaluating the effectiveness of certain selective serotonin reuptake inhibitors (SSRIs) in the management of neuropathic pain and they have been found to be effective (336); however, the evidence for the use of SSRIs is not as positive as SNRIs (351). Currently there is insufficient evidence to recommend the use of antidepressants for the management of lower back pain, although they are frequently used for this condition (48, 352). Studies often reviewed the efficacy of specific antidepressants, it is however likely that the analgesic benefits would be a class effect.

Generally, TCAs and gabapentinoids are used preferentially over SSRIs and SNRIs due to demonstrated efficacy (351). TCAs are not recommended in the elderly; rather SNRIs, SSRIs, gabapentinoids, capsaicin cream or lignocaine patches are recommended preferentially (289) due to the risk of adverse events, particularly anticholinergic events (16, 108). Some of the side effects of adjuvants are similar to that of opioids such as sedation; however, due to the mode of action being vastly different, opioids and gabapentinoids have a different side effect profile. Pregabalin can cause visual disturbance, confusion, lethargy, memory impairment, weight gain, dry mouth, constipation, hallucinations, cardiac abnormalities and rarely bloody dyscrasias (220). Gabapentin can cause memory impairment, peripheral oedema, weight gain, dry mouth, psychosis and rarely movement disorders (220). Recently, there has also been concern raised regarding the abuse potential of gabapentin and pregabalin, and their use has been linked with a number of deaths (353).

Other adjuvants used more commonly in perioperative pain management, but increasingly in persistent pain and more recently, refractory depression, include the NMDA antagonists, primarily ketamine (354, 355). Ketamine causes a number of different effects throughout the body; however, the exact mode of action is still somewhat unclear (356). Ketamine works by blocking NMDA and HCNI receptors and reduces the ability for nociception to occur (356). Ketamine can reduce the opioid requirements in postoperative pain, as well as opioid-related adverse events, (48, 357) although the results are inconsistent and the dose, route of administration and co-prescribed therapies make it challenging to estimate the true efficacy (357, 358). Overall, the main benefit associated with ketamine appears to be in the prevention of hyperalgesia and allodynia, and reduced likelihood of tolerance to opioids (48, 359-361). It has a narrow therapeutic margin, which can limit its use as an analgesic, and increase the risk of

sedation or psychotomimetic effects (356). Ketamine has both immediate and delayed effects, and analgesic effects can continue beyond the duration of drug effect. (356)

Some other adjuvant agents tend to be mainly used in acute pain management. Alpha-2 agonists, in particular clonidine, can improve analgesia following surgery; however, they are associated with significant adverse effects including hypotension and bradycardia, which limit its use (48, 362, 363). Dexamethasone has also been shown to reduce the level of postoperative acute pain experienced as well as nausea and vomiting (48, 364). This effect appears to be more consistent if dexamethasone is given pre-operatively rather than intraoperatively (365).

Overall adjuvants can be useful for certain types of pain conditions particularly neuropathic, however the evidence is variable and the side effect profile requires careful dose adjustment and patient selection.

2.2.5 Nerve blocks

Local, regional (for example brachial-plexus blockade) or spinal and epidural anaesthesia nerve blocks are frequently employed in the management of acute and persistent pain. These can be administered as bolus doses into the nerve or continuous infusions in an area proximal to the nerve or nerve plexus (366).

2.2.5.1 Nerve blocks effectiveness

All local anaesthetics have similar efficacy; however, their duration of action and duration until toxicity can occur vary between the treatment options (367). These can be administered either locally or via epidural; however, epidural analgesia has been found to be more effective when given in combination with opioids (48). Nerve blocks have been found to be opioid-sparing, improve postoperative pain management and reduce length of stay in hospital (48, 367). Although a recent Cochrane review suggested that trials supportive of the use of local anaesthetics infiltration in the peritoneal cavity following elective cholecystectomies were liable to bias, they however appeared to result in lower pain scores compared to the control group (368). Generally these medications are used for acute pain; however, there is evidence to support the use of lignocaine in chronic neuropathic pain, particularly with the use of a patch (48, 367). Local anaesthetic and abdominal nerve blocks have been found to reduce opioid consumption following a caesarean section (369), breast surgery (although not clinically significant) (370) and evidence to support the efficacy of nerve blockages at reducing PPP is positive (371). However, deficiencies in study methodology, including small sample size, variability in dose, route of

administration and study protocols that are liable to bias, including lack of concealment and failure to report all outcomes, are limitations of all these studies (369-371).

Continuous peripheral nerve blocks have been found to reduce postoperative opioid consumption, and are associated with faster functional recovery and reduced length of stay (372). Continuous peripheral nerve blocks have been found to be effective in the management of acute postoperative pain, particularly thoracic and orthopaedic surgery and increasingly ambulatory surgery (372). A Cochrane review found that a femoral nerve block following a total knee arthroplasty was more effective than an opioid given by patient controlled analgesia (PCA) alone and equivalent to an epidural (373). This same study found that using continuous peripheral nerve block was more effective than a single bolus injection (373). Evidence to support the use of these medications following joint surgery though are variable with some demonstrating negligible benefit (374). Thus, much of the evidence to support use of regional blockade and local anaesthetics is subject to bias and although they appear beneficial, more studies are needed to ascertain the true benefit of these interventions in both acute and persistent pain conditions.

2.2.4.2 Safety of nerve blocks

Generally the adverse effects associated with local anaesthetic blockades are minimal, and anaphylaxis is rare (367), however local anaesthetics systemic toxicity (LAST) can occur. LAST is more common in the very young (less than four months) or old (aged over 70 years), those with heart conditions, metabolic disease or acidosis, liver disease or low blood protein levels (367). LAST can present with both cardiovascular effects and/or central nervous effects. Cardiovascular effects include arrhythmias, both tachycardia and bradycardia, decreased blood pressure and heart failure (severe toxicity) (367). CNS effects can included altered sensations including tingling of lips, peripheral numbness, tinnitus, metallic taste, vomiting, muscle twitching, sleep disturbance, confusion, sedation and potentially respiratory failure and death (severe toxicity) (367). There is also a risk of nerve damage due to the nature of the procedure (367).

The use of regional blockades is associated with a reduced risk of toxicity and overdose (367) compared to standard use of local anaesthetics. The most common side effects reported with regional blockades are nerve injury, catheter infection (0-3.2%), LAST and bleeding (366). The incidence of nerve injury is variable between retrospective (0.5-1%) and prospective studies (10-15%) (366). A Cochrane review found that patients at high risk of cardiac problems who underwent a regional anaesthesia had a lower risk of mortality in the first 30 days than general anaesthesia (375). However, there does not appear to be a benefit in other types of surgery, such as caesarean section, where safety for mother and child are comparable to general anaesthesia

(376). Overall more prospective studies are required to ascertain which types of nerve blocks work most effectively for different surgical procedures.

2.3 Areas requiring further research

As mentioned throughout the previous section, the evidence to support the use of analgesic medications is often variable, with methodological deficiencies. This area requires substantially more head to head multicentred, randomised, longitudinal controlled studies with patient outcomes related to physical function, pain intensity and adverse events to ascertain the true risk and benefit of these medications. Unfortunately, these trials are difficult to conduct and extremely costly. Sponsorship by pharmaceutical industry may increase the likelihood of bias, whether actual, potential or perceived. Moreover, with availability of so many different pain-causing conditions, management strategies and availability of over-the-counter analgesics, controlling these studies is fraught with difficulty. In addition, due to the compounding factors associated with pain and the experience of pain, controlling for patient variability in psychological, biological and social/environmental factors would be near impossible. Having said this, trials should be conducted to better determine efficacy and adverse effects. Until that point, trial and error and careful patient selection and individualisation of management strategies should be encouraged to improve patient function, improve tolerability and minimise risk of harm.

The draft Australian Pain Strategy, an update from the 2010 version (36), has been recently published (35). The National Pain Strategy has six goals: including pain as a national health priority; improving knowledge and skills in clinicians and consumers; quality improvement and evaluation; interdisciplinary pain clinic access and research (35). The Pain Strategy's sixth goal, research, includes many aspects such as undertaking evaluation of interventions for persistent pain management, assess attitudes towards pain and its management, and assessing the safety and efficacy of pain management in older patients (36). A policy paper (38) in Australia also suggested further areas for research should include: identification of risk factors for the development of persistent pain conditions, improving the management of persistent pain, and reducing the harms around persistent pain management, specifically opioids.

It is difficult to generalise internationally published literature to the Australia situation due to a number of varying practices and laws surrounding the use of opioids. There is a relative dearth of published data regarding the use of prescription opioids and analgesic use in Australia. Only a limited number of studies have been published evaluating analgesic management of pain in Australia. A number in New South Wales (6, 57, 58, 377, 378), one study in South Australia (7),

one in Queensland (379) and seven national reviews (21, 23, 25, 26, 380-382) of the use of opioids (without patient demographics, co-prescribed therapies, medical conditions), two reviews evaluating analgesics in ACFs (383, 384) and another in emergency departments (385). Thus the lack of generalisability of some of these papers, as well as the time that has elapsed since some of these articles were published, coupled with the recommendation of the National Pain Strategy and the policy paper by the Royal Australian College of Physicians indicate the need for more research to evaluate how pain is being managed in Australia, who is taking analgesics, and what the risk factors for persistent pain are (38).

Despite a significant number of studies identifying factors increasing the risk of persistent pain, a number of areas still remain poorly described in the literature. It is for this reason that the Royal Australian College of Physicians' policy paper suggests that this is an area that requires further research (38). At the 14th World Pain Congress, held in August 2012, PPP was highlighted as an area that requires additional research to identify causative factors and ways to optimise patient outcomes (386). Although a number of the studies have been undertaken in this field, they are small, of relatively poor quality or do not contain enough variables to ascertain predictors of chronicity and thus questions still remain over causative factors and ways to optimise therapy (81-83, 199, 211, 387). Additionally, few studies have followed patients with acute post-surgical pain following discharge, to determine any links between management in this phase and the development of PPP (388, 389).

As previously noted, the management of pain is challenging with poor trial evidence, difficult patient populations with multiple comorbidities and difficult to use clinical guidelines. Thus, identifying ways that pain could be managed better may assist not only with the patient's QOL and physical function, but also may assist in identifying ways to reduce the likelihood acute pain will progress to persistent pain. To address these gaps in the literature, this PhD was developed with four major objectives:

- Observe how pain is managed pharmacologically by patients, GPs, surgeons and anaesthetists;
- Identify what factors are associated with the development of PPP;
- Identify QUM issues related to the management of pain; and
- Identify the barriers and enablers to pain management.

Chapter 3: Patient self-management of pain in the week following discharge after surgery: an Australian prospective observational study

3.1 Abstract

Background: Up to 80% of patients experience acute pain following surgery. There is limited understanding about how patients take analgesics to manage this pain following discharge. This study aimed to address this gap and identify barriers to optimal post-discharge pain management.

Methods: A prospective observational study was conducted at the RHH, Australia between November 2014-March 2015. Eligible participants were 18 years or older, undergoing surgery requiring an incision; patients undergoing surgery related to cancer, childbirth or multi-trauma or those with dementia were excluded. Participants were identified through hospital discharge lists and mailed a survey within one week of discharge. This survey asked about post-discharge pain, analgesic consumption and whether patients recalled being given advice regarding their pain management.

Results: 500 surveys were mailed with 169 (33.8%) being returned. The median age of the participants was 57 years (range: 18-92 years); 53% were female. The majority (89.3%) of participants recalled receiving information about their pain management. Analgesics were reported to be used by 95.4% of participants in the week following discharge. Self-report moderate-severe pain was noted by 80 participants (47.3%); 63.7% of those, reported using fewer analgesics than directed, with 11.3% using more analgesics than directed.

Conclusion: It was concerning to see a high proportion of patients reporting underusing their analgesics despite experiencing moderate-severe pain. Although the vast majority of participants reported receiving advice regarding pain management, this did not appear to translate into optimal pain management and a different approach to the provision of advice would appear to be necessary.

3.2 Introduction

Up to 80% of patients undergoing a surgical procedure requiring an incision will experience acute postoperative pain (390). Uncontrolled acute postoperative pain has the potential to decrease QOL, reduce participation in rehabilitation activities, increase the risk of PPP and venous thromboembolism through inactivity, as well as increase the likelihood of readmission to hospital or extending the length of the initial hospital admission (82, 388, 391-393).

In hospital, especially large public hospitals, pain is carefully managed in the peri- and postoperative phase by a multidisciplinary team. However, pain relief in the period following discharge from hospital is less structured and has less oversight by health care professionals. Numerous studies have found that patients often experience more pain after discharge than during their admission (48, 204, 393-397). Post-discharge, patients must manage their own pain, making judgements about their level of pain and use of analgesics, which may be influenced by adverse effects, as well as patients' expectations and underlying concerns related to use of medication for pain. To assist each patient's self-management it is recommended that they are provided with detailed information regarding how to manage their pain after discharge (398).

However, to be effective, adequate pain management requires that patients follow the advice they are given. Numerous studies have found that patients do not take their analgesics as prescribed. This includes patients with persistent pain both under and overusing their analgesia (399-407) as well as patients with metastatic cancer (408-411) underusing their analgesia. However, there have been fewer studies (395, 396, 412, 413) reviewing how patients self-manage their acute and sub-acute pain, and whether they are adherent to the advice provided regarding their medications.

Additionally, there has been a trend towards a reduced length of hospital stay following major surgery and increasing use of day surgery for more minor procedures (414); both of which result in patients being required to self-manage their pain at home for a greater length of time. Thus, identifying how patients manage their pain following discharge is increasingly relevant. To assist in filling this gap in the literature, this study aimed to evaluate how patients take analgesics, if they are adherent to the pain management advice given and where they obtain analgesics from. From this, the barriers to optimal pain management in the post-discharge period could be identified and strategies to improve management recommended.

3.3 Methods

A prospective cross-sectional observational study was conducted at the RHH, Tasmania, Australia. This study followed patients who had undergone a surgical procedure between December 2014-March 2015. Posters were displayed on relevant surgical wards of the RHH to inform patients of the study.

Patient discharge lists and the digital medical records (DMR) were reviewed to identify patients who had undergone a surgical procedure at the RHH and were discharged home no more than seven days after surgery. Patients were included if they were 18 years or more and underwent

any type of surgery (both elective and emergency) that required an incision. Participants underwent operations including sternotomies, orthopaedic or spinal related procedures, open or laparoscopic abdominal/genitourinary operations, wound debridement with reconstruction as well as operations associated with the sinus, eye or eye lids, mouth region and thyroid.

Patients were excluded if they: had experienced a multiple trauma emergency; had a direct cancer-related procedure; had a non-invasive procedure (e.g. colonoscopy or cystoscopy); or were a resident in an ACF. Eligible patients were sent the paper-based survey in the mail within seven days of being discharged home. Patients with a past medical history of dementia or those who developed postoperative cognitive decline were also excluded through assessment of their DMR. Following the return of the written survey (within 14 days of discharge), the DMR was then accessed again to record further details about the patient's hospital admission. This information included: length of stay, comorbidities, inpatient analgesic use, perioperative management and whether the hospital's APS had been involved with their care during their admission.

Written surveys (Appendix 1 and 2) included basic demographic details, level of education, self-reported pain intensity during the seven days following discharge using an 11-point visual analogue scale, analgesic consumption following discharge (including drug, dose and directions of actual use), a description of the information (including verbal and written information) they had been given pre- and post-surgery regarding pain management after discharge and who they recalled giving them this advice; whether they adhered to the advice (self-reported) and whether they took their analgesics as prescribed, more than prescribed or less than prescribed. Patients were also asked why they did or did not follow the advice given to them and where they obtained their analgesics from. The quality of the advice was not assessed as part of this study. Partially completed surveys were included where answers were provided.

It was estimated that approximately 500 eligible patients would undergo surgery during the recruitment period at the RHH, with approximately 80% of these people likely to experience acute postoperative pain (390). From this, a sample size of 165 patients was calculated as being required for a statistically significant sample size to review the outcome of acute pain, using a confidence interval of 0.05. An incentive was used to enhance recruitment, which was the chance to win one of five $100 AUD gift cards.

Statistical analysis was performed using SPSS Statistics 20 for Windows (SPSS Inc., Chicago, II, USA). Chi-square and Mann-Whitney U tests were used to evaluate patient and treatment differences between those who experienced moderate-severe pain in the week following surgery

and those who did not. Multiple variable binary logistic regression was undertaken to analyse the independent associations of variables between those who experienced moderate-severe pain following discharge and those who did not. All variables with a p value of <0.1 in the univariate model were included in the logistic regression mode. A p-value of <0.05 was considered to be statistically significant. This study was approved by the Health and Medical Human Research Ethics Committee (Tasmania).

3.4 Results

Five hundred surveys were posted to eligible patients during the recruitment period; of those, 169 were returned (33.8%). The median age of the participants was 57 years (range: 18-92 years) and 53% of were female. Participants undergoing elective procedures accounted for 55% of the cohort. Self-reported moderate-severe pain (≥4 on the 11-point visual analogue scale) in the week following discharge was experienced by 47.3% of participants. Participants were asked what their average level of pain across the week since being discharged home was; the median score reported was 3 (range 0-10). Table 4 shows the differences in patient characteristics and pain management between those who reported experiencing moderate-severe pain and those reporting mild or no pain.

The vast majority (89.3%) of patients were provided (or recalled being provided) some advice regarding their pain management following discharge. Nurses (46.7%), doctors (35.5%), pharmacists (30.2%) and anaesthetists (13.6%) were reported most frequently as having provided advice. Thirty-two percent of respondents recalled being provided advice by more than one health care professional. Written information (either pre-admission or during discharge) was recalled as being provided to 72.1% of patients. Most (78.7%) of the patients stated that they followed the advice that they were given. For those people who reported not following advice, they were most likely to report taking their analgesics differently to that prescribed.

Analgesics were used by 95.3% of participants in the week following discharge, with 67.8% of patients using more than one class of analgesics. Underuse of analgesics, relative to the advice provided, was more commonly reported (28.4%) than overuse (5.3%). For those patients taking less analgesics than advised, the mostly commonly cited reasons were: not needed due to no/little pain (22.9), side effects (20.8), fear of overuse/running out (4.2%), not understanding directions (4.2%) and used to the pain/try and tolerate pain without analgesics (6.3%). Moderate-severe pain was reported by 63.7% of those reporting underusing their analgesics. Ten patients reported taking more than 4g of paracetamol daily, with three patients taking 8g daily. Eight of these patients reported experiencing moderate-severe pain (p=0.03). Eight participants also

commented that they felt they were underprepared or had insufficient information to be able to self-manage their pain following discharge; of those, 75% rated their average pain intensity as moderate-severe in the week following discharge.

Medications that were used in the week following discharge were most commonly provided by the hospital at the time of discharge (69.8%). Other sources of analgesics were reported to be purchased from a community pharmacy (28.2%); via a prescription from a GP (25.9%); analgesics already in the home (6.5%) or purchased from a supermarket (5.6%). Opioids were reported as being taken by 59.7% of participants in the week following discharge, with 27.2% of participants reporting they used an NSAIDs and 78.6% reporting they used paracetamol. One patient also reported using illicit drugs in addition to their analgesics.

Non-pharmacological strategies were reported to be used by 35.5% of participants. Cold and/or heat packs (18.9%) and active strategies such as massage, physiotherapy, exercise and stretching (18.9%) were most frequently used. A smaller proportion of participants (8.8%) reported using passive strategies such as rest, repositioning, elevation and praying, and five participants reported using other strategies including vitamin supplementation.

Table 4 Patient demographics of those who self-reported experiencing, on average, moderate-severe pain in the week following discharge and those who did not.

Variable	Self-reported mild or no pain n=89 (%)	Self-reported moderate-severe pain n= 80 (%)	P value
Baseline demographics			
Median age (IQR)	59.0 (48.5-68.0)	55.0 (43.3-66.5)	0.16
Female (%)	44 (49.4)	45 (56.2)	0.38
Level of education			
≤ Year 10	34 (38.6)	27 (34.6)	0.68
Year 11/12	26 (29.5)	28 (35.9)	
Post-graduate education	28 (31.8)	23 (29.5)	
Employment status			
Employed	34 (38.2)	32 (40.0)	0.12
Retired	33 (37.1)	19 (23.8)	
Unemployed/disability pension	22 (24.7)	29 (36.2)	
Elective (%)	39 (43.8)	49 (61.3)	0.09
Type of Surgery			
Head (sinus, nasal, oral, ocular, thyroid)	16 (18.0)	4 (5.0)	0.02
Musculoskeletal (including spinal)	28 (31.5)	44 (55.0)	
Open abdominal/genitourinary	8 (9.0)	8 (10.0)	
Laparoscopic abdominal/genitourinary	19 (21.3)	12 (15.0)	
Wash out/debridement of wound	15 (16.9)	10 (12.5)	
Cardiothoracic	3 (3.4)	2 (2.5)	
Reviewed by the APS	12 (13.5)	20 (25.0)	0.06
What was their expected level of pain			
None	15 (17.4)	5 (6.4)	0.01
Mild	37 (43.0)	25 (32.1)	
Moderate/severe	34 (39.5)	48 (61.5)	
Length of stay (nights)			0.33
0	8 (9.0)	8 (10.0)	
1 or 2	41 (46.1)	33 (41.2)	
3 or 4	20 (22.5)	27 (33.8)	
≥5	20 (22.25)	12 (15.0)	
Medical History			
Median number of comorbidities (range)	2.0 (0.0-4.5)	2.0 (0.0-4.0)	0.78
Pre-existing analgesic use	26 (29.2)	32 (40.0)	0.14
Pre-existing persistent pain	23 (25.8)	45 (56.2)	<0.01
Previous history of anxiety	6 (6.7)	2 (2.5)	0.20
Previous history of depression	12 (13.5)	10 (12.5)	0.85
Recalled provision of advice			
Given written and/or verbal advice regarding pain management	81 (91.0)	70 (87.5)	0.05
Given advice on how many analgesic tablets/capsules to take	63 (73.3)	50 (62.5)	0.14
Given advice on what analgesics to take	64 (74.4)	58 (72.5)	0.78
Given advice on when to contact the hospital	50 (58.1)	39 (48.8)	0.23
Given advice on what activities they could/could not do following discharge	51 (59.3)	41 (51.9)	0.34
Provided any written advice	66 (74.2)	56 (70.0)	0.55
Attended a pre-assessment meeting	56 (62.9)	45 (56.2)	0.38
Followed advice post-discharge	70 (88.6)	63 (90.0)	0.78

Self-reported post-discharge pain management			
Patient self-reported use of analgesics:			
Underused	28 (31.5)	20 (25.0)	<0.01
As prescribed	61 (68.5)	51 (63.7)	
Overused	0 (0.0)	9 (11.2)	
Was provided analgesics on discharge	51 (57.3)	67 (83.8)	<0.01
Used an opioid following discharge	39 (43.8)	62 (77.5)	<0.01
Used an NSAID following discharge	25 (28.1)	21 (26.2)	0.79
Used paracetamol following discharge	65 (73.0)	68 (85.0)	0.06
Used a gabapentinoid following discharge	1 (1.1)	6 (7.5)	0.04
Used non-pharmacological strategies	27 (30.7)	33 (41.8)	0.14

IQR: interquartile range; APS: Acute Pain Service; NSAID: non-steroidal anti-inflammatory medicines

Table 5 Factors associated with self-reported moderate-severe pain following discharge in multivariate analysis

Variable	**OR (95%CI)**	**P value**
Elective (%)	1.64 (0.62-4.38)	0.18
Type of Surgery		
Head (sinus, nasal, oral, ocular, thyroid)	1	0.20
Musculoskeletal (including spinal)	5.66 (1.28-	
Open abdominal/genitourinary	25.01)	
Laparoscopic abdominal/genitourinary	6.36 (1.07-	
Wash out/debridement of wound	37.93)	
Cardiothoracic	2.29 (0.47-	
	11.13)	
	4.66 (0.83-	
	26.21)	
	4.71 (0.32-	
	69.36)	
Pre-existing persistent pain	3.16 (1.19-8.39)	0.02
Reviewed by the APS	0.49 (0.16-1.54)	0.22
Recalled being supplied written and/or verbal advice regarding pain management	0.20 (0.05-0.83)	0.03
Provided analgesics on discharge	1.66 (0.42-6.64)	0.47
Reported using an opioid following discharge	3.14 (0.90-	0.07
	11.00)	
Reported using paracetamol following discharge	1.63 (0.62-4.30)	0.33
Reported using a gabapentinoid following discharge	4.13 (0.37-	0.25
	46.05)	
What was their expected level of pain		
None	1	0.20
Mild	1.91 (0.48-7.62)	
Moderate/severe	3.5 (0.79-12.74)	

OR: odds ratio; CI: confidence interval; APS: Acute Pain Service

3.5 Discussion

The burden of pain in the week following surgery was high, with 47.3% of patients reporting they experienced moderate-severe pain. Numerous studies have shown that high levels of acute pain following surgery is one factor that can increase the risk of persistent pain (82, 388, 391-393). However, the effect of high pain intensity in the period following discharge has not been well researched (388, 389). In the few studies conducted in this area, which have reviewed patients following orthopaedic surgery, have shown an association between high pain intensity following

discharge and the development of PPP (206-208, 415). From this study it appears that post-discharge pain is often (although not always) being undermanaged, by both clinicians and patients, and is an area that requires increased attention to improve patient outcomes.

The reported use of analgesics following discharge was high, with 95.3% of participants using them in the first week. While this is not surprising, what is concerning is only 70% of the participants received analgesics on discharge. This is despite the knowledge that at least 80% of patients who undergo surgery, requiring an incision, will suffer acute pain (390) and recommendations to tailor discharge medications accordingly (203). Admittedly patients who reported experiencing moderate-severe pain were more likely to report receive analgesics on discharge (83.8% vs 57.3% $p<0.01$). However, with 6.5% of patients reporting they used analgesics that they already had at home, it appears that a significant proportion of patients were discharged with potentially limited access to analgesics. Depending on the time of their hospital discharge, accessing supplies of analgesia outside of the hospital may have been difficult and this may have detrimentally affected their pain control. These findings are supported by another study that found that a minority of patients were discharged from hospital with sufficient pain management planning (412). With so many patients going to a health care professional in the week following surgery (28.2% going to a community pharmacy and 25.9% to a GPs) to get additional analgesia, it suggests that provision of analgesia at discharge is sub-optimal. Post-discharge pain management and planning for discharge requires more attention, to ensure that patients have sufficient knowledge and analgesia to self-manage their pain adequately.

The pattern of analgesic use in our study was similar to that seen in other studies evaluating what analgesics patients used following discharge (395, 396, 412). However, this study also identified that participants frequently reported underuse of their analgesics. Underuse was more commonly reported (28.4%) by patients than overuse (5.3%), which has been found previously in patients with acute pain (404). The most common reasons patients self-reported under using their analgesics were side effects or low levels of pain. This has been found in other studies also, with side effects, "putting up with the pain", avoidance of any medication and fear of addiction frequently cited as reasons for under using analgesics (395, 396, 404, 413, 416). Particularly in older patients, who tend to demonstrate more stoicism, it is important the information provided explains the role of using analgesics and the importance of not tolerating pain unnecessarily, due to the risk of both short and long-term adverse consequences from sub-optimal control of acute pain.

Although the quality of the information provided to patients prior to discharge was not ascertained in this study, a number of patients did note that they felt ill equipped to manage their

pain following discharge. Of the patients who noted this, 75% reported experiencing moderate-severe pain. This finding is supported by a recent Australian study (396) that found that 30% of patients discharged after a total knee arthroplasty felt they had received "somewhat adequate" or "inadequate" information on their discharge analgesics. This is an area that requires further research to identify what information patients would like to receive, in what level of detail and how this is best presented to them in order for them to feel well equipped to manage their pain following discharge. Additionally, who the advice regarding post-discharge pain management was provided by, was reported to be inconsistent. To ensure all patients have good outcomes following their discharge it is important that it is determined within the hospital's structure whose responsibility it is to provide this type of advice to patients.

Patients who reported experiencing moderate-severe pain were more likely to undergo musculoskeletal surgery, including spinal and orthopaedic surgery. This is not surprising as these types of surgery are highly invasive. Having a pre-existing persistent pain problem (25.8% versus 56.2% p=<0.01) was also associated with reporting moderate-severe pain following discharge. Those patients who recalled receiving pain management advice were slightly less likely to experience moderate-severe pain (87.5% vs 91% p=0.05). Patients who reported experiencing moderate-severe pain were more likely to comment that they expected this level of pain compared to those who did not (p=0.01). It would appear that the APS is also identifying those patients more likely to experience acute pain; however, still only 25% of those who reported experiencing moderate-severe post-discharge pain were reviewed by the APS, and thus improvements could be made in this area.

A number of factors were found to be independently associated with participants reporting moderate-severe pain following discharge. Patients undergoing open abdominal or genitourinary surgery or musculoskeletal surgery were also more likely to report experiencing pain following surgery, which is not unexpected as these surgeries have significant potential for acute pain, than less invasive procedures such as debridement of wounds or laparoscopic procedures. A history of persistent pain increased the likelihood of reporting moderate-severe pain following discharge, which is not unsurprising as persistent pain has been found to increase the likelihood of developing further pain conditions as well as being more sensitive to pain (81, 82, 141). Conversely, recalling receiving advice regarding pain management reduced the likelihood of reporting moderate-severe pain. These findings indicate the importance of receiving information regarding pain management on a patient's treatment outcome and, potentially, with more information, pain intensity could conceivably reduce further.

This study has a number of strengths including its prospective design which has less risk of recall bias regarding the level of pain experienced, how they managed their pain and where they obtained analgesics from. There were, however, some limitations in this study, including the relatively small sample size and the reliance on patients' recollection of the advice they were given during their admission, which is likely to be affected by analgesic consumption and the residual effects of anaesthesia. In addition, discharge advice was not able to be cross-matched with discharge summary advice to verify discharge advice. Nonetheless, if patients do not recall receiving information, then it is important that more written or alternative forms of information are provided to all patients so that they have the resources to use in the event that they experience pain following discharge. Although this study had a response rate of approximately 30%, there still may have been the potential for self-selection bias with those patients more engaged in their health care or those who experienced more problems with their pain management more likely to respond. However, the results of this study do mirror another Australia study (396) and thus is likely to be generalisable to other post-hospital settings.

In conclusion, this study suggests that moderate-severe acute pain following hospital discharge after surgery is a significant issue. Although most patients recalled receiving information about pain management, the way in which it was provided and/or the quality of the information may need to be reviewed to try and improve pain management in this sub-acute period. This study also identifies a number of areas that require more research. The first is to identify what patients would like to know in order to feel equipped to manage their pain and how this is best delivered, the second is whose responsibility it is to provide post-discharge advice to patients to ensure all patients receive counselling regarding post-discharge pain management, and finally whether patients are provided enough analgesics on discharge to allow for safe and effective pain management following discharge.

Chapter 4: Pain and physical function following sternotomy: a prospective 12-month observational study

All of the research contained within this chapter has been published as Veal FC, Bereznicki LR, Thompson AJ, Peterson GM, Orlikowski CE, "Pain and functionality following sternotomy: a prospective 12-month observation study" Pain Medicine pp. 1-8. ISSN 1526-2375 (2016). DOI: 10.1093/pm/pnv066

4.1 Abstract

Objective: to document self-reported pain intensity, physical function and analgesic use in the 12 months following a sternotomy to identify factors associated with the development of persistent post-sternotomy pain.

Design: Prospective observational study

Settings: Royal Hobart Hospital, Australia

Subjects: Patients undergoing a sternotomy between January-November 2013

Methods: One hundred and ten patients were recruited and followed for 12 months, with telephone calls at ten days, six weeks, three months and 12 months. An initial survey was completed at the point of recruitment including patient history, depression and anxiety scales, self-rated health and pain catastrophising scale.

Results: The mean age of participants was 69.6 years, with the majority of participants being male (84.5%). The proportion of patients reporting pain in the early post-discharge period was high, with 30% of patients reported experiencing on average moderate-severe pain in the 10 days following discharge and 11% reported experiencing on average moderate-severe pain at six weeks. At 12 months, 15.5% of participants reported on average mild pain and 0.9% an average of moderate-severe pain in the preceding week at their sternotomy site. Pain of neuropathic origin was reported by 41.2% of those with on average daily pain at 12 months.

Conclusion: This study highlights the need for further research to investigate whether more intensive pain management in the post-discharge period following sternotomy as well as the early identification of patients with neuropathic pain symptoms can reduce the incidence of persistent postoperative pain at 12 months.

4.2 Introduction

Chronic pain places a major burden both on those patients affected and the wider healthcare system. There are many potential causes of chronic pain, amongst which is PPP, defined as pain that develops after surgery and lasts for at least two months where other causes, including pre-existing pain conditions, have been excluded (200). One British study found that surgery was implicated as a possible cause in approximately 20% of all patients with chronic pain requiring referral to pain clinics (417). It has been reported that the prevalence of PPP amongst those who have undergone surgery is between 30-50%, with 5-10% of patients suffering severe pain (81). Studies, both prospective and retrospective, have identified variable levels of pain following sternotomy, ranging from 18% (418) to 35% (419) in prospective studies and from 23% (420) to 56% (421) in retrospective studies with follow-up periods of at least 12 months. A subset of patients experienced moderate to severe pain, with rates varying from 6% (422) to 36% (421) of patients in retrospective studies and 6% (423) to 29% (419) of patients in prospective studies.

High levels of postoperative pain, as well as high analgesic consumption in the immediate postoperative period, have been identified as risk factors for PPP (81, 82, 201). Research has reported that patients often experience more pain following discharge from hospital after surgery than during the inpatient phase (394). One study also found that patients who underwent a sternotomy had high levels of pain in the three weeks following their discharge (424). Some studies evaluating patients who have undergone orthopaedic surgery or trauma have found that high pain intensity following hospital discharge increased the likelihood of pain persisting at 6-12 months (206 , 207, 208). However it is unclear if there is an association between pain during the sub-acute phase (after discharge and up to three months following surgery) and pain persisting at 12 months following a sternotomy. Furthermore, very little research has evaluated the level of pain experienced after discharge following a sternotomy, the effect this pain has on physical function and the presence of neuropathic symptoms during this time. Thus, this study aimed to evaluate baseline patient and clinical factors and the level of pain that patients experience during the subacute phase and to follow these patients for 12 months to determine the prevalence of ongoing pain and whether higher pain intensity during the sub-acute phase increases the likelihood of pain persisting at 12 months.

4.3 Methods

The study population comprised patients undergoing a sternotomy at the RHH, a 550-bed hospital with the only cardiothoracic unit in the state of Tasmania, Australia. Recruitment took place on weekdays between January and November 2013. Patients were recruited either the afternoon prior to surgery or for a minority of patients up to five days after surgery, and at this time an initial survey was conducted in person. To be eligible, participants had to speak English

and be aged at least 18 years. It was estimated that approximately 180 sternotomies would be undertaken at the RHH during the recruitment period; with an assumed incidence of PPP of 40%, and a confidence interval of 0.05 a sample size of 121 patients was needed for statistical significance to identify factors associated with PPP.

Baseline demographic and clinical characteristics were recorded during the initial interview (Appendix 3) including age, gender, pre-existing pain and analgesic use, comorbidities and medications. The Depression, Anxiety, Stress Scale 21 (DASS21) (425) and Pain Catastrophizing Scale (PCS) (426) were also administered. A score of 30 or more on the PCS is considered to be clinically significant (170) and was used as the cut-off point in this study. There are no clinically significant cut off points determined for DASS21 (425); however, scores indicating moderate to extreme symptoms were used as a cut off point for statistical purposes. Participants were also asked to rate their level of optimism (1 very pessimistic, 10 very optimistic), health (1 very unhealthy, 10 very health), pain tolerance (1 copes very well with pain, 10 unable to cope with pain), fear of pain (1 not scared of pain, 10 very scared of pain) and whether they had family or friends who would be able to support or assist the patient when discharged home during this initial interview. Average postoperative pain intensity over the first 48 hours at rest and on movement as well as opioid consumption, converted to MEQ during the first 48 hours following surgery were also recorded from the patient's medical notes.

Participants were telephoned at ten days, six weeks, three months and 12 months following their hospital discharge (Appendix 4 and 5). If the initial attempt to contact the patient at day ten or at six weeks failed, the patient was telephoned daily for the following five days; at three months, patients were telephoned daily for 10 days. If they could not be reached at any of these time points no data was collected and the patient was contacted as per the next point in the research protocol. If the participant could not be reached at 12 months, contact was attempted for one month; if they could still not be reached then no further action was taken and they were classified as being lost to follow-up and excluded from the study. During these calls, patients were asked to classify their level of pain at the sternotomy site (worst and average in the last week), physical function over the last week and analgesic use in the past 24 hours (irrespective of indication) were recorded. Pain scores were assessed via a numerical rating scale, which were later converted to three pain categories (none, mild, moderate-severe). When patients were unsure what numerical value to assign to a pain score, they were asked to grade their pain as either none, mild, moderate or severe. The 7-item Douleur Neuropathique 4 (DN4) was administered at three and 12 months to further document the characteristics of the pain; a score of three or more is considered to be consistent with pain of neuropathic origins (427). All baseline and telephone interviews were conducted by the same researcher to reduce the likelihood of variation in

questioning or interpretation of patient responses. Daily opioid doses were converted to MEQ (299)

Statistical analysis was conducted using SPSS Statistics 20 for Windows (SPSS Inc., Chicago, Il, USA). Chi-Square and Mann-Whitney U tests were undertaken to assess for group differences at 12 months. Differences in baseline demographics, clinical characteristics, intraoperative and postoperative factors, as well as pain scores at different time points, were tested between those patients who experienced pain at 12 months and those who did not. The study was approved by the University of Tasmania's Health and Medical Research ethics committee and all participants gave informed consent for participation.

4.4 Results

One hundred and thirty patients were approached, with 122 patients agreeing to participate. Twelve patients were subsequently excluded from the study due to the following reasons: cancelled surgery (4), death (2), withdrawal of consent due to illness (2), and loss to follow-up at 12 months (4). Thus, 110 patients were included in the study. The mean age of the participants was 69.6 years, with the majority of participants being male (84.5%). Seventy-three patients (66.4%) underwent sternotomy as part of a coronary artery bypass graft (CABG), with or without a valve replacement; 35 patients (30.9%) underwent a valve replacement only or Bentall procedure (where the aortic root and valve are replaced) and two patients for other reasons. The response rates for surveys were 90.9% at 10 days, 97.3% at six weeks, and 96.4% at three months.

Table 6 shows the baseline demographics and clinical characteristics of patients with and without pain at 12 months. Younger age (p=0.03) and self-rated poor health (P=0.05) were associated with experiencing daily pain on average at 12 months. A previous musculoskeletal pain causing condition (p=0.02) and increased number of pain sites (p=0.03) were also associated with pain at 12 months. However the association was not seen with a specific type of musculoskeletal pain; with neither back pain (41.2% versus 23.7% p=0.13) nor joint pain (47.1% versus 30.1% p=0.17) being associated with pain at 12 months.

Table 6 Baseline demographics and clinical characteristics

	Self-reported no pain (on average) at sternotomy site at 12 months n= 93	**Self-reported pain (on average) at sternotomy site at 12 months n= 17**	**P value**
Baseline characteristics			
Median age in years (IQR)	73.0 (66.0-78.0)	68.0 (59.5-73.0)	0.03
Male (%)	75 (80.6)	16 (94.1)	0.18
Education level (%)			
University/diploma	17 (18.3)	2 (11.7)	0.62
Completed year 12	33 (35.5)	8 (47.1)	
<High school	43 (46.2)	7 (41.2)	
Married/de-facto (%)	75 (80.6)	11 (64.7)	0.14
Operation type (%)			
CABG (± valve replacement)	61 (65.6)	12 (70.6)	0.80
Valve/Bentall Procedure	30 (32.3)	5 (29.4)	
Other	2 (2.2)	0 (0.0)	
Resternotomy required postoperatively	3 (3.2)	2 (11.8)	0.12
Previous sternotomy	6 (6.5)	1 (5.9)	0.93
Pre-operative PCS ≥ 30 (%)	3 (3.2)	0 (0.0)	0.45
Pre-operative anxiety (DASS21 ≥ 10) (%)	19 (20.4)	7 (41.2)	0.06
Pre-operative depression (DASS21 ≥ 14) (%)	20 (21.5)	6 (35.3)	0.22
Pre-operative stress (DASS21 ≥ 19) (%)	29 (31.2)	9 (52.9)	0.08
Median number of medications (IQR)	7.0 (5.0-9.0)	6.0 (3.0-7.0)	0.15
Median number of medical conditions (IQR)	5.0 (3.5-6.0)	5.0 (3.0-6.0)	0.66
Diabetes Mellitus	15 (16.1)	2 (11.8)	0.65
Musculoskeletal pain (%)	43 (46.2)	13 (76.5)	0.02
Non-musculoskeletal pain (%)	61 (65.6)	14 (82.4)	0.17
Number of pain sites	1.0 (1.0-2.0)	2. (1.0-3.5)	0.03
Pre-existing regular use of analgesics (%)	28 (30.1)	5 (29.4)	0.95
Pre-existing use of opioid analgesics (%)	16 (17.2)	5 (29.4)	0.24
Duration of previous pain (%)			
No pain	24 (25.8)	2 (11.8)	0.62
≤2 years	2 (2.2)	0 (0.0)	
2-5 years	29 (31.2)	5 (29.4)	
5-10 years	8 (8.6)	2 (11.8)	
≥10 years	30 (32.3)	8 (47.1)	
Self-rated optimism (IQR)	8.0 (6.0-9.0)	8.0 (5.0-8.8)	0.21
Self-rated health (IQR)	7.0 (5.0-8.0)	5.5 (3.5-7.8)	0.05
Self-rated pain tolerance (IQR)	3.5 (2.0-5.0)	3.0 (1.0-4.3)	0.20
Self-rated fear of pain (IQR)	1.75 (1.0-5.4)	1.0 (1.0-2.8)	0.16
Smoking (%)	6 (6.5)	3 (17.6)	0.12
Median average weekly alcohol consumption (IQR)	1.0 (0.0-7.0)	0.25 (0.0-3.3)	0.46
Support on discharge (%)	77 (82.8)	15 (88.2)	0.58
Intra- and postoperative factors			
Median intraoperative opioid (mg) use (IQR)	200 (200-200)	200 (110-200)	0.29
Use of PCA (%)	89 (95.7)	17 (100)	0.40
On average moderate-severe pain on movement in the 48 hours after surgery (IQR)	38 (40.8)	9 (52.9)	0.28
On average moderate-severe pain on rest in the 48 hours after surgery (IQR)	8 (8.6)	0 (0)	0.20
Median postoperative opioid consumption (oral MEQ/day) (IQR)	137.4 (98.8-232.4)	172.5 (126.2-242.2)	0.24
Use of postoperative regular paracetamol (%)	84 (90.3)	15 (87.5)	0.79

Follow-up factors			
Reported moderate-severe average 10 day pain (%)	23 (27.7)	6 (37.5)	0.43
Reported moderate-severe average 6 week pain (%)	4 (4.4)	1 (6.7)	0.70
Reported moderate-severe average 3 month pain (%)	4 (0.0)	0 (0.0)	0.37
DN4 ≥3 at 3 months (%)	11 (12.5)	7 (43.8)	0.01
DN4 ≥3 at 12 months (%)	3 (3.2)	7 (41.2)	<0.01

N: number; IQR: interquartile range; APS: Acute Pain Service; CABG: Coronary artery bypass graft; PCS: Pain Catastrophizing Scale; DASS21: Depression Anxiety Stress scale 21; PCA: patient controlled analgesia MEQ: morphine equivalence/day; mg: milligram; DN4: Douleur Neuropathique 4

A DN4 score of three or more at three months (p=0.01) was associated with pain persisting at 12 months. Sternum pain, with probable neuropathic origins was reported by 41.2% of patients who had pain persisting at 12 months, with only three people having a DN4 score of three or more at 12 months not having pain on average at the sternotomy site (p<0.01). Reported moderate to severe pain at 10 days, six weeks or three months following discharge was not associated with pain at 12 months.

There was a generally consistent approach to intraoperative management, with most patients receiving propofol infusions and 200mcg fentanyl, there was minimal use of nerve blocks (three patients) and intraoperative paracetamol. Gabapentinoids were prescribed to one patient in the postoperative period, with a further four taking pregabalin in the follow-up period for unrelated medical conditions.

Table 7 shows the level of pain that patients reported experiencing and their ability to undertake certain activities at ten days, six weeks, three months and 12 months. At 12 months, 34.5% of participants were still experiencing pain at the surgical site. The proportion of patients reporting post-discharge pain at 10 days was high. Eighty-five patients reported experiencing at least mild pain on average, yet only 82.1% (69) of these patients were taking any analgesics. Amongst those patients experiencing on average moderate-severe pain, 89.7% were taking an analgesic at 10 days. A number of patients commented during the telephone survey that they preferred to reserve the use of analgesics (including non-opioid analgesics) for more severe pain or when they really needed them. At three months, 28 patients reported suffering, on average, at least mild pain and only 50.0% of these were taking analgesics.

Table 7 Self-reported pain scores and physical function across the follow up period

Time period	10 days n= 100 (%)	6 weeks n=107 (%)	3 months n=106 (%)	12 months n=110 (%)
Pain – worst in past week				
None	4 (4.0)	30 (28.0)	48 (45.3)	72 (65.5)
Mild	27 (27.0)	48 (44.9)	45 (42.5)	29 (26.4)
Moderate	32 (32.0)	20 (18.7)	10 (9.4)	5 (4.5)
Severe	37 (37.0)	9 (8.4)	3 (2.8)	5 (4.5)
Pain – average over last week				
None	15 (15.0)	41 (38.3)	77 (72.6)	92 (83.6)
Mild	55 (55.0)	55 (51.4)	25 (23.6)	17 (15.5)
Moderate	29 (29.0)	11 (10.3)	4 (3.8)	1 (0.9)
Severe	1(1.0)	0 (0)	0 (0)	0 (0)
Effect of pain on sleep				
None	57 (57.0)	79 (73.8)	91 (85.8)	99 (90.0)
Mild	25 (25.0)	23 (21.5)	12 (11.3)	7 (6.4)
Moderate	9 (9.0)	2(1.9)	2 (1.9)	3 (2.7)
Severe	9 (9.0)	3 (2.8)	1 (0.9)	1 (0.9)
Effect on activities of daily living				
None	68 (68.0)	88 (82.2)	102 (96.2)	110 (100)
Mild	26 (26.0)	16 (15.0)	4 (3.8)	0 (0)
Moderate	5 (5.0)	2 (1.9)	0 (0)	0 (0)
Severe	1 (1.0)	1 (0.9)	0 (0)	0 (0)
Effect on walking 100m				
None	89 (89.0)	102 (95.3)	103 (97.2)	110 (100)
Mild	4 (4.0)	3 (2.8)	2 (1.9)	0 (0)
Moderate	5 (5.0)	1 (0.9)	0 (0)	0 (0)
Severe	2 (2.0)	1 (0.9)	1 (0.9)	0 (0)
Effect on participating in hobbies				
None	94**(94.0)	96**(89.7)	99**(93.4)	103 (93.6)
Mild	3 (3.0)	8 (7.5)	5 (4.7)	4 (3.6)
Moderate	2 (2.0)	2 (1.9)	2 (1.9)	3 (2.7)
Severe	1 (1.0)	1 (0.9)	0 (0)	0 (0)
Analgesic use in past 24 hours (not specific to post-surgical pain)				
Paracetamol	75 (75.0)	48 (44.3)	35 (31.4)	36 (32.7)
Mean daily dose (g)	3.6g	2.8g	2.5g	2.4g
Opioids (mg MEQ)	18 (18.2)	2 (1.9)	5 (4.8)	6 (5.5)
Mean daily dose (range)	12.5 (2.5-30)	38.5 (7.5-69.5)	31.4 (1-108.5)	21.0 (2.6-60)

** the restrictions on their movement were dictated by surgeons rather than pain being the main factor affecting participation in hobbies.
Note: patients often rated that on average they had no pain over the previous seven days, however they may have had short last pain associated with movement or sneezing, which they rated in worst level of pain experienced in the previous seven days.
G: Gram; mg MEQ: milligram morphine equivalence/day

Self-reported average pain intensity at 12 months were low, with 16.4% of patients reporting pain. Pain at 12 months had no effect on the patient's ability to perform activities of daily living or to walk 100m. PPP affected 6.3% of the participants' ability to undertake hobbies, and in 10.0% their ability to sleep; however, in most cases these impacts were only reported as mild.

4.5 Discussion

This is the first published Australian study evaluating post-sternotomy pain and the first study we are aware of that comprehensively documents the sub-acute phase following a sternotomy. We found the 12-month prevalence of PPP to be 34.5% however this took into account pain that was short lived and associated with a particular activity or movement. Only 16.4% of patients reported experiencing pain, on average, every day at the sternotomy site. Taking into account the differences in the way questions were asked of participants and the classification of persistent pain, the results are reasonably consistent with prospective studies of similar duration in other countries (418, 419, 428).

Undermanagement of pain in the acute phase immediately following surgery is a known risk factor for the development of pain at 12 months (419). This current study demonstrated better pain control than was recently reported in a Norwegian study (429); this difference was perhaps explained by the opioid consumption in the 48 hours following surgery being nearly four times higher in this study than the Norwegian study. Although nearly half of the patients reported moderate to severe pain on movement following surgery and 8.6% suffered moderate-severe pain at rest, average pain intensity in the 48 hours following surgery were not associated with pain persisting at 12 months and this may be explained by the high use of PCA possibly reducing central sensitisation occurring.

Previous studies following patients who underwent orthopaedic surgery or experienced an orthopaedic trauma have indicated that high pain intensity during the sub-acute phase following hospital discharge increased the risk of pain persisting to 6-12 months (206-208). No study has previously studied the sub-acute period in depth following a sternotomy to identify if high pain intensity persist, for how long for and what impact this has on long-term pain. Despite a significant amount of pain reported following discharge by patients, moderate-severe pain following discharge was not associated with pain at 12 months for this cohort. However further research evaluating whether more intensive pain management following discharge results in a reduction of the incidence and severity of pain persisting at 12 months is still needed.

Although pain intensity during the sub-acute period were not associated with pain at 12 months, reported neuropathic pain symptoms at three months were associated with pain at 12 months. Furthermore, patients who reported experiencing on average pain at 12 months were more likely to have a DN4 score of greater than three. This is not surprising as PPP is often associated with neuropathic symptoms, although the incidence was higher in this study than others (430). It is acknowledged however, that the 7-point DN4 scale is not as specific as the 10-point scale incorporating a physical examination. Nonetheless, the 7-point scale provides an easy to administer screening test, which could be easily incorporated as part of a follow-up procedure to

identify at risk patients. Additionally, neither pregabalin nor gabapentin were used routinely in the immediate postoperative period. This is despite some evidence they can improve acute pain (340, 341, 431) and potentially reduce the incidence of persistent pain following surgery (342); although this evidence is currently conflicting, and requires further studies to ascertain what role gabapentinoids have in the management of acute and persistent post-operative pain.

Thus, there is a clear impetus to increase the amount of follow-up undertaken to identify those at high risk of developing neuropathic pain and improve the pain management of patients who undergo surgery and are then discharged home. Providing more intensive pain management following discharge from hospital has the potential to improve patients' QOL and physical function. Furthermore, in this cohort, improved pain control may facilitate engagement and capacity to participate in cardiac rehabilitation after surgery and potentially reduce mortality, morbidity and hospital readmissions related to cardiovascular disease (432-434). However, treating older patients' pain, such as those in this study, has a number of barriers. Once patients are discharged home they self-manage this pain. Factors including fear of addiction to medication and reserving analgesics for severe pain only have been previous noted as reasons for lower analgesic use in older populations (435-437) and participants in our study also raised these concerns. Therefore, any approach to improving pain management during the subacute phase after discharge from hospital must include patient education to allay concerns and reduce barriers to appropriate use of analgesics.

In our study, younger age, poorer self-rated health, previous persistent musculoskeletal pain, and a higher number of pain sites were all associated with pain persistence at 12 months, which is consistent with the factors previously identified as increasing the risk of PPP (81, 82, 141-144, 438-440). Previous studies have indicated that pre-operative anxiety was a risk factor for acute pain and possibly persistent pain as well, although the results are variable (200). In this study a greater proportion of patients who had moderate-severe pre-operative anxiety did have moderate-severe pain at 12 months (20.1% versus 40.2%) however this was only trending towards statistical significance ($p=0.06$). Potentially if the sample size had been met this would have been statistically significant between the groups. Theoretically conducting a minority of initial baseline surveys following surgery may have resulted in slightly different levels of reported pre-operative anxiety affecting this result. Alternatively potentially anxiety may be less of a risk factor in older patient cohorts such as this one. Nonetheless, early screening of patients at pre-assessment clinics to identify those patients with poor self-rated health and pre-operative anxiety, and referring them to a psychologist prior to surgery could aid in reducing the risk of developing PPP in the future.

There are a number of strengths to this study related to the prospective methodology; in particular, the avoidance of recall bias. The main limitation was the small sample size, potentially underestimating the effect of some variables, namely pre-operative anxiety and stress, which were both trending towards statistical significance. However, this study demonstrates that pain following sternotomy is a significant problem, with over one-third of patients still experiencing pain at the operation site 12-months postoperatively. Positively, most patients reported that PPP only had a limited detrimental effect on their functional ability.

The results of this study demonstrate the need for increased education of patients around pain management after discharge; the best way to overcome these barriers and optimise pain management warrants further investigation. There is also a need for future research to evaluate whether more intensive and increased reliance on multimodal pain management (including gabapentinoids) following discharge helps reduce both the prevalence and severity of persistent post-sternotomy pain at 12 months. The optimal way to do this, whether through more face-to-face consultations or regular follow-up phone calls with health care practitioners with additional pain-related training, should be evaluated further. Finally, the early identification of those patients with symptoms consistent with neuropathic pain should also occur to ensure that higher risk patients are identified early and managed more closely. As the most effective treatment for persistent pain is preventing it occurring in the first place, early identification and management of high-risk patients is imperative to improving patient outcomes.

Chapter 5: Persistence of pain and functional impairment following orthopaedic surgery: a prospective 12 month observational cohort study

All of the research contained within this chapter has been published as Veal FC, Bereznicki LR, Thompson AJ, Peterson GM, Orlikowski CE, "Persistence of pain and functional impairment following orthopedic surgery: a prospective 12 month observational cohort study" *Medicine (Baltimore): Analytical Reviews of General Medicine, Neurology, Psychiatry, Dermatology and Pediatrics*, **94** (36) doi:10.1097/MD.0000000000001498 ISSN 0025-7974 (2015).

5.1 Abstract

Objective: The aim of this study was to document the level of pain and physical function in the 12 months following orthopaedic surgery.

Methods: An observational prospective cohort study was undertaken, following 87 patients (mean age 62.4 years (18-92); 47.1% male) who required orthopaedic surgery at the RHH, Tasmania, Australia. Following an initial survey, patients were telephoned at ten days, six weeks, three months and 12 months after discharge.

Results: Post-discharge pain intensity were high with 97.4% of patients suffering pain at 10 days, 81.2% at six weeks and 79.5% at three months. Pain affected the ability to undertake activities of daily living for 32.7% and 20.0% of patients at 10 days and six weeks respectively. Twelve months after discharge, 65.5 % of patients reported pain persisting at the surgical site, with 29.9% of all patients suffering moderate-severe incidental pain; and nearly one quarter of patients reported pain affected their sleep or activities of daily living. Average pain intensity rated as moderate-severe at 10 days (p=0.01) and six weeks (p=0.02) and neuropathic pain symptoms at three months (30.2% vs 10.3% p=0.03) and 12 months (30.4% vs 4.9% p=0.01) were associated with persistent pain at 12 months.

Discussion: Pain in the period following discharge from hospital is significant and undermanaged. Additionally, moderate-severe pain following discharge, and neuropathic pain symptoms at three months were associated with persistent pain at 12 months. These findings have important implications for improving QOL as well as potentially preventing persistent pain.

5.2 Introduction

Up to 80% of patients undergoing surgery will experience acute postoperative pain (390). Under management of postoperative pain is common (394) and can increase the risk of persistent pain (82, 388), poor healing, venous thromboembolism, myocardial infarction, readmission to hospital

and extended length of hospital stay (391-393). One study found that following discharge from hospital for a surgical procedure, patients' pain intensity often got worse (394). Another study evaluating post-discharge pain after a total knee arthroplasty (204) found that one month after discharge 52% of patients reported moderate pain and 16% severe pain whilst walking. Thus the issue of post-discharge pain is significant and can decrease QOL and ability to participate in rehabilitation activities.

High opioid consumption following surgery and increased levels of acute postoperative pain are known risks factors for PPP (82). Pain relief in the period following discharge from a surgical unit is potentially more complicated to manage than that during the inpatient phase. Patients are in charge of their own medication, there is sometimes a gap (perceived or actual) in terms of who is responsible for treating the patient (GP or surgeon), and there may be a reduction in the potency or dosing frequency of opioid analgesics when patients transition from an inpatient to home environment. The potential for an association between high pain intensity following hospital discharge after surgery or trauma, and pain and physical function at 12 months has received minimal attention in the literature (388, 389). To address this gap in the literature, we aimed to evaluate the level of pain, analgesic consumption and functional status of patients over the 12 months following orthopaedic surgery, and identify if higher pain intensity during the sub-acute period (following discharge from hospital to three months after surgery) increase the risk of persistent pain at 12 months.

5.3 Methods

A prospective, observational study was conducted following patients who underwent orthopaedic surgery for a joint replacement or fracture repair at the RHH, a 550-bed hospital in Tasmania, Australia between January and December 2013. At the time of recruitment, participants were required to be an inpatient and either have undergone surgery within the past five days, or have been scheduled to undergo surgery during their admission. Exclusion criteria were patients aged less than 18 years, an inability to speak English, a history of dementia or suspected cognitive decline; and those who experienced a multi-trauma event, allowing the focus to be on one surgical site.

At the point of recruitment an initial face-to-face survey was conducted (Appendix 6). Participants were then contacted by telephone ten days, six weeks, three months and 12 months after discharge from the orthopaedic ward (Appendix 4 and 5). If the initial attempt at contact for the ten day, six week or three month surveys was unsuccessful, the participant was telephoned daily for between five and ten days. If the participant could not be reached after this time no data was collected for that time point and the participant was contacted at the next scheduled data

collection point. At 12 months, all participants were telephoned and where the initial attempt was unsuccessful, repeated calls were made for one month, before the participant was considered lost to follow up.

During the initial survey basic demographic and clinical characteristics of the patient were collected including age, social history and previous pain conditions. In addition, the Hospital Anxiety and Depression Survey (HADS) was administered at baseline. A HADS score of eight or more for anxiety or depression is considered to be clinically significant (441). The PCS was also administered at baseline, with a PCS score of 30 or more considered to be clinically significant (170, 426). Participants were also asked to rate their level of optimism (1 very pessimistic, 10 very optimistic), health (1 very unhealthy, 10 very health), pain tolerance (1 copes very well with pain, 10 unable to cope with pain), fear of pain (1 not scared of pain, 10 very scared of pain) and whether they had support when discharged home during this initial interview.

The participant's medical notes were reviewed to collect information about intraoperative and acute postoperative pain and its management, as well as medications and medical conditions on admission. The information collected during the follow-up interviews included the average and the worst levels of pain over the previous week as well as a number of aspects regarding physical function including sleep and ADLs. Analgesic use in the 24 hours prior to the interview was also recorded (irrespective of the indication for use) and opioid doses were converted to oral MEQ (299). At three and 12 months the 7-item DN4 questionnaire was also administered; a score of three or more on the seven point scale was classified as being consistent with pain of neuropathic origins (427).

Analysis was performed using SPSS Statistics 20 for Windows (SPSS Inc., Chicago, Il, USA). Chi-square and Mann-Whitney U tests were undertaken to evaluate for group differences. Associations between baseline demographics, clinical characteristics, intraoperative and postoperative factors as well as pain scores at different time points were tested against those who experienced pain at 12 months and those who did not. A p-value of <0.05 was considered to be statistically significant. The University of Tasmania's Health and Medical Research ethics committee granted approval for this project and all patients gave informed consent to participate in this study.

5.4 Results

One hundred and twenty patients were approached for inclusion in the study, with 101 patients agreeing to participate. Fourteen patients were subsequently excluded for the following reasons: death (1); withdrawal from the study due to ill health/personal reasons (7); lost to follow-up (5); required further surgery (1).

Table 8 shows the demographics and clinical characteristics of the participants. There were no statistically significant differences in relation to baseline characteristics between those who experienced on average, at least mild pain at 12 months and those who did not experience pain. The use of intraoperative ketamine was significantly different between the groups, with patients prescribed intraoperative ketamine being more likely to have pain persisting at 12 months (34.8% vs 14.6% p=0.03). Patients who were administered regular paracetamol postoperatively appeared less likely to experience pain at 12 months, although this was not statistically significant (p=0.07). Persistent pain at 12 months was associated with moderate-severe levels of pain (on average) at 10 days (p=0.01) and six weeks (p=0.02); and also with a DN4 score of three or more, at three months (p=0.03) and 12 months (p=0.01).

Table 8 Baseline demographics and clinical characteristics according to pain at surgical site at 12 months following surgery (n=87)

Variable	No pain at surgical site 12 months following surgery n= 41	Pain surgical site at 12 months n=46	P value
Baseline characteristics			
Median age in years (IQR)	65 (50-76)	63 (57-71.5)	0.81
Female (%)	21 (51.2)	25	0.77
Education level (%)			
University/diploma	14 (34.2)	8 (17.4)	0.19
Completed year 12	16 (39.0)	24 (52.2)	
<High school	11 (26.8)	14 (30.4)	
Married/de-facto (%)	19 (46.3)	26 (56.5)	0.34
Operation type (%)			
Elective joint replacement	19 (46.3)	19 (41.3)	0.36
Emergency hip arthroplasty	5 (12.2)	2 (4.3)	
Dynamic hip screw/intramedullary nail	4 (9.8)	9 (19.6)	
Open reduction and internal fixation	13 (31.7)	16 (34.8)	
Emergency surgery (%)	22 (53.7)	27 (58.7)	0.64
Pre-operative PCS ≥ 30 (%)	8 (19.5)	8 (17.4)	0.80
Pre-operative anxiety (HADS ≥ 8) (%)	13 (31.7)	19 (41.3)	0.35
Pre-operative depression (HADS ≥ 8) (%)	8 (19.5)	7 (15.2)	0.60
Median number of medications (IQR)	4 (1.5-7)	4 (2-8.3)	0.54
Median number of medical conditions (IQR)	4 (2.0-5.5)	4 (2-6.3)	0.56
Previous pain causing condition (%)	31 (75.6)	37 (80.4)	0.59
Pre-existing regular use of analgesics (%)	24 (58.5)	30 (65.2)	0.52
Pre-existing use of opioid containing analgesics	7 (17.1)	5 (10.9)	0.40
Number of pain sites	1.0 (0.5-2.0)	2.0 (1.0-3.0)	0.09
Duration of previous pain			
No pain	10 (24.4)	9 (19.6)	0.41
≤2 years	3 (7.3)	3 (6.5)	
2-5 years	6 (14.6)	11 (23.9)	
5-10 years	11 (26.8)	6 (13.0)	
≥10 years	11 (26.8)	17 (37.0)	
Self-rated optimism	7.0 (5.5-8.3)	8.0 (5.8-9.0)	0.52
Self-rated health	7.0 (5.0-8.0)	7.0 (5.0-8.0)	0.58
Self-rated pain tolerance	3.3 (2.0-5.0)	3.0 (2.0-4.2)	0.51
Self-rated fear of pain	1.0 (1.0-4.3)	1.8 (1.0-5.6)	0.38
Smoking	6 (14.6)	7 (15.2)	0.94
Alcohol	0 (0-3.0)	2.0 (0.0-10.0)	0.06
Support on discharge	37 (90.2)	39 (84.8)	0.44
Intraoperative factors			
Median Intraoperative opioid (mg) use (IQR)	49.0 (20.0-75.9)	58.9 (26.9-77.5)	0.83
Intraoperative 40mg parecoxib use (%)	13 (31.7)	16 (34.8)	0.76
Intraoperative ketamine use (%)	6 (14.6)	16 (34.8)	0.03
Epidural (%)	2 (4.9)	6 (13.0)	0.19
Regional nerve block (%)	9 (22.0)	11 (23.9)	0.83
Intraoperative local anaesthetic use (%)	11 (26.8)	10 (21.7)	0.58
Intraoperative IV paracetamol	7 (17.5)	11 (23.9)	0.47

Postoperative (in hospital) factors			
Use of PCA (%)	21 (51.2)	26 (56.5)	0.62
Median pain on movement in the 48 hours after surgery (11 point numerical scale) (IQR)	2.8 (0.5-4.7)	3.9 (1.9-5.2)	0.10
Median pain at rest in the 48 hours after surgery (11 point numerical scale) (IQR)	2.0 (0.5-4.1)	2.8 (1.0-4.0)	0.68
Median postoperative opioid consumption (oral MEQ/day) (IQR)	139.0 (70.0-204.0)	159.5 (74.4-238.0)	0.46
Use of postoperative ketamine (%)	3 (7.3)	5 (10.9)	0.57
Use of postoperative regular oral paracetamol (%)	39 (95.1)	38 (82.6)	0.07
Use of Postoperative oral regular NSAID (%)	10 (24.4)	11 (23.9)	0.96
Reviewed by the APS (%)	22 (53.7)	30 (65.2)	0.27
Postoperative gabapentinoid	1 (2.4)	1 (2.2)	0.93
Follow-up factors			
Moderate to severe average 10 day pain	9 (24.3)	25 (59.5)	0.02
Moderate to severe average 6 week pain	3 (8.1)	13 (29.5)	0.02
Moderate to severe average 3 month pain	3 (7.3)	8 (18.2)	0.14
DN4 ≥3 at 3 months	4 (10.3)	13 (30.2)	0.03
DN4 ≥3 at 12 months	2 (4.9)	14 (30.4)	0.01

N: number; IQR: interquartile range; APS: Acute Pain Service; PCS: Pain Catastrophizing Scale; HADS: Hospital Anxiety and Depression Scale; PCA: patient controlled analgesia MEQ: morphine equivalence/day; mg: milligram; NSAID: non-steroidal anti-inflammatory agent; DN4: Douleur Neuropathique 4

Table 9 shows the level of pain, physical function and analgesic use across the 12-month follow-up period. At 10 days, 97.4% of participants reported pain, with 43.6% experiencing moderate-severe pain on average. Pain affected 69.3% of patients' ability to sleep and 38.5% of patients' ability to undertake ADLs. Analgesic use was high with 80.8% taking paracetamol and 56.4% taking opioids; 97.1% of participants with moderate-severe average pain used analgesics at ten days.

Table 9 Pain scores and physical capabilities across the follow-up period

Time period	**10 days n= 78 (%)**	**6 weeks n=80 (%)**	**3 months n=83 (%)**	**12 months n=87 (%)**
Pain – worst in past week				
None	2 (2.6)	15 (18.7)	17(20.5)	30 (34.5)
Mild	16 (20.5)	29 (36.3)	36 (43.3)	31 (35.6)
Moderate	29 (37.2)	25 (31.3)	19 (22.9)	16 (18.4)
Severe	31 (39.7)	11 (13.7)	11 (13.3)	10 (11.5)
Pain – average over last week				
None	4 (5.1)	22 (27.5)	29 (34.9)	41 (47.2)
Mild	40 (51.3)	42 (52.5)	43 (51.8)	33 (37.9)
Moderate	31 (39.7)	15 (18.7)	10 (12.1)	11 (12.6)
Severe	3 (3.9)	1 (1.3)	1 (1.2)	2 (2.3)
Effect of pain on sleep				
None	24 (30.8)	41 (51.2)	52 (62.7)	66 (75.9)
Mild	29 (37.2)	22 (27.5)	22 (26.5)	15 (17.3)
Moderate	19 (24.3)	9 (11.3)	7 (8.4)	3 (3.4)
Severe	6 (7.7)	8 (10.0)	2 (2.4)	3 (3.4)
Effect on ADLs				
None	49 (62.8)	64 (80.0)	63 (75.9)	66 (75.9)
Mild	17 (21.8)	12 (15.0)	17 (20.5)	15 (17.2)
Moderate	8 (10.3)	3 (3.8)	1 (1.2)	4 (4.6)
Severe	4 (5.1)	1 (1.3)	2 (2.4)	2 (2.3)
Effect on walking 100m**				
None	17 (21.8)	30 (37.5)	53 (63.9)	72 (82.8)
Mild	8 (10.2)	12 (15.0)	13 (15.7)	8 (9.2)
Moderate	3 (3.9)	6 (7.5)	3 (3.6)	0 (0)
Severe	17 (21.8)	6 (7.5)	5 (6.0)	7 (8.0)
N/A	33 (42.3)	26 (32.5)	9 (10.8)	0 (0)
Effect on participating in hobbies*	18 (23.1)	34 (42.5)	48 (57.9)	69 (79.3)
None	3 (3.8)	4 (5.0)	9 (10.8)	8 (9.2)
Mild	2 (2.6)	4 (5.0)	2 (2.4)	3 (3.4)
Moderate	10 (12.8)	4 (5.0)	4 (4.8)	7 (8.1)
Severe	45 (57.7)	34 (42.5)	20 (24.1)	0 (0)
N/A				
Analgesic use in past 24 hours (not specific to post-surgical pain)				
Paracetamol	63 (80.8)	50 (62.5)	40 (48.2)	33 (37.9)
Mean dose (g) (range)	3.0 (0.5-5.3)	2.3 (0.5-4.0)	2.6 (0.5-4.0)	2.4 (0.5-5.0)
Opioids (mg MEQ)	44 (56.4)	29 (36.3)	22 (26.5)	17 (19.5)
Mean dose (range)	27.3mg (2.5-90)	23.2 (1.9-82.5)	28.2 (7.5-105)	36.6 (3.75-135)

* N/A: not applicable - At 10 days, 6 weeks, and 3 months, pain was often not affecting the patient's ability to walk or undertake hobbies rather the doctor's directions or injury restrictions prevented the patient from undertaking these task. Thus patients rated these as pain having no effect on the ability to undertake those activities.
N: number; MEQ: morphine equivalence/day; mg: milligram

At six weeks, 20.1% of participants experienced on average moderate-severe pain. Pain affected 48.8% of patients' ability to sleep and 20.3% of patients' ability to undertake ADLs. Amongst those with moderate-severe pain, 94.1% reported taking analgesia.

By three months, pain intensity continued to improve, although 65.1% of participants were still experiencing some pain, with 13.3% experiencing moderate-severe average pain. At three months, 37.3% of patients found pain at the surgical site affected their sleep and 24.1% found pain affected their ability to undertake ADLs. Analgesics were taken by 90.1% of participants with moderate-severe average pain.

At 12 months, 65.5% of participants reported at least mild pain during the week prior to the follow-up, with 14.9% of participants experiencing moderate-severe average pain. Nearly one quarter of participants reported that pain was adversely affecting their sleep, and/or their ability to perform ADLs. Analgesics were taken by 84.6% of participants with moderate to severe average pain, with 61.5% of this group taking an opioid. Four people with a DN4 of three or more at 12 months were taking opioids dosages ranging from 30mg to 135mg MEQ/d.

5.5 Discussion

This study followed 87 people for a twelve-month period after they underwent orthopaedic surgery. The level of pain as well as functional impairment following orthopaedic surgery was considerable. At 12 months, over 50% of patients reported experiencing some persistence of pain at the surgical site in the previous week. The use of analgesics, although generally high throughout the follow up period, was still sub-optimal in some cases, with a number of participants experiencing moderate-severe pain but not taking analgesia. This study also found that moderate-severe average pain scores during the sub-acute period following hospital discharge was associated with pain 12 months following surgery. This finding is supported by other studies that found pain at discharge (206), high pain intensity in the first month after a hip fracture surgery (208) and pain at three months following a major trauma (207) all were associated with persistent pain beyond six to 12 months.

There is clear evidence that the management of pain after discharge is an area that requires increased attention, not only with regard to the impact this has on persistence of pain 12 months following surgery, but also to improve the QOL and functional status of patients. A range of actions would be required to achieve this objective including greater patient education regarding management of postoperative pain and when to seek further assistance with pain management as well as additional follow up with the health care practitioners following discharge.

There were no statistically significant differences between the groups in relation to baseline demographics, however this may be due to the small sample size. The apparently counterintuitive finding that participants prescribed ketamine in the intraoperative period were more likely to have pain at 12 months is potentially due to anaesthetists identifying these patients

as being at a higher risk of acute or persistent pain. Amongst those patients who did not receive regular postoperative paracetamol, 80.0% had persisting pain at 12 months, although this association was not statistically significant due to the small sample size. Considering the good safety profile of paracetamol and evidence suggesting it reduces opioid consumption following surgery (442), it is concerning to see ten patients were not prescribed regular paracetamol postoperatively.

A DN4 of three or more at three months was associated with pain at 12 months; and for those with pain at 12 months, a DN4 of three or more was common. This was not surprising as a number of studies have identified persistent postoperative pain often has a neuropathic component (82, 430, 443). Despite this, the use of gabapentinoids postoperatively was minimal, even though some studies have indicated that it can reduce acute postoperative pain and opioid consumption (340, 341, 431) and PPP (342). Further research into the role, optimal dose and duration of postoperative use of gabapentinoids is needed; however, increased use of gabapentinoids and early identification and management of those with neuropathic symptoms may potentially aid in reducing the incidence and severity of persistent pain following surgery.

There are a number of strengths to this study, including the prospective nature and high participant retention rate throughout follow-up. This study could have been improved through the additional recording of discharge advice from the hospital based on medical notes to identify if patients followed this advice, as well as physiotherapy intervention following discharge to ascertain if this affected outcomes also. Whilst the small sample size is a limitation that needs to be acknowledged; this study nonetheless shows that pain and disability in the post-discharge period following orthopaedic surgery is considerable and undermanaged. In addition, we found that moderate-severe average pain scores at ten days and six weeks postoperatively, were associated with pain persisting at 12 months. These findings have important implications for improving QOL during this period as well as potentially preventing PPP. This study highlights the need for additional research to evaluate whether increased intervention regarding pain management following hospital discharge can improve pain outcomes and physical function 12 months after orthopaedic surgery.

Chapter 6: Use of opioid analgesics in older Australians

All of the research contained within this chapter has been published as Veal FC, Bereznicki LRE, Thompson AJ, Peterson GM, "Use of opioid analgesics in older Australians", *Pain Medicine*, 2015: 16 (8) pp. 1519-27. doi:10.1111/pme.12720

6.1 Abstract

Background: Persistent pain is a common complaint in elderly patients. However, pharmacological management strategies, including the use of opioids, are complicated in elderly patients due to comorbidities, polypharmacy, and the risk of adverse events.

Objective: To identify potential medication management issues associated with the use of opioids for persistent pain in elderly Australians.

Design: Retrospective cross-sectional review of the utilisation of analgesics in 19,581 people who underwent a medication review in Australia between 2010-2012 was undertaken.

Results: The average age of the population was 77±13 years. Opioid analgesics were documented as being taken by 31.8% patients, with 22.1% patients taking these regularly. Three major medication management issues were identified. Of patients documented as taking regular opioid analgesics, only 49.1% were recorded as also taking regular paracetamol at a dose of 3-4g/day. Concurrent use of anxiolytics/hypnotics amongst those taking regular opioid analgesics was common (45%). Finally, only 60% of those taking regular opioid analgesics were also taking a laxative.

Conclusion: A pragmatic, quick reference guide for the pharmacological management of persistent pain in older people is needed. It should emphasise the initial use of optimised non-opioid analgesia, highlight the risk of anxiolytics/hypnotics contributing to falls and fractures in people taking opioid analgesics, and the need for concurrent laxatives in people taking regular opioids.

6.2 Introduction

Up to 80% of ACF residents and 50% of older persons living in the community suffer from persistent pain (444). Persistent pain is a difficult condition to treat effectively in any population. However, pain management in older patients has a number of additional challenges including polypharmacy increasing the likelihood of drug-drug interactions, comorbidities increasing the

likelihood of drug-disease interactions. As well as changes and variability in the pharmacokinetics and pharmacodynamics of analgesics (108), changes in perception of pain (101), and patient related barriers to pain management (445).

Clinical guidelines often focus on which patients are good candidates for opioid analgesics and provide limited guidance as to what medications should be co-prescribed with opioid analgesics and at what dose. Opioid analgesics are not recommended as first-line treatment or in isolation of other pharmacological and non-pharmacological treatment options (108, 297, 312, 313). Yet, opioid analgesics are increasingly prescribed for the management of persistent pain, demonstrated by the dramatic increase in their use (21-24) and treatment duration (22, 27). In line with this increasing use, there has been a trend towards increasing rates of deaths associated with opioid analgesic use (27-29), proportionally to the opioid dose being taken (27, 318). For non-cancer pain, Australian guidelines recommended a maximum opioid dose equivalent to 100-120mg of oral MEQ per day (94, 312). However, the risk of overdose and adverse events, such as falls and fractures, exists at doses significantly lower than this recommended maximum (319, 329, 446).

In Australia, the PBS (447), which is the national formulary for government subsidised medicines, generally lists opioids as restricted for the management of "severe disabling pain not responding to non-narcotic analgesics". The restriction is silent on the issue of co-prescription of non-opioid analgesics. Despite this restriction, a recent Australian study evaluating the PBS prescriptions dispensed for veterans in Australia found that 34% of community patients and 20% of ACF residents commenced on oxycodone had not received non-opioid analgesics in the previous four months (382).

This study aimed to identify potential medication management issues in relation to the use of opioid analgesics in the treatment of persistent pain amongst older Australians undergoing a medication review, and suggest ways to improve the management of persistent pain.

6.3 Methods

A retrospective cross-sectional study of people undergoing medication reviews in Australia was undertaken. In Australia, two forms of pharmacist-conducted comprehensive medication reviews are undertaken, HMR for community dwelling patients with multiple medications and/or comorbidities and RMMR for any permanent ACF residents.

Pharmacists can choose to enter data from these reviews into different software programs to aid in assessing patient therapy and report writing. Medscope™ is one such software system. All patient records in the Medscope™ database as of June 2012 were included in this review. The extract, contained 19,996 de-identified medication reviews conducted between January 2010 and June 2012; 382 reviews were excluded as they included no medical history.

Patient's date of birth and review, gender, allergies and medical history, type of review undertaken (HMR or RMMR) and medications prescribed (or purchased over-the-counter), including dose and directions, were included in the database.

Opioids that were prescribed for non-pain indications were excluded from the study, namely methadone liquid, dihydrocodeine and pholcodine cough mixtures and codeine linctus if the directions indicated it was prescribed for non-pain symptoms (e.g. cough). All regularly-dosed (RD) opioids were converted to the daily oral MEQ based on an Australian conversion table (299). Non-opioid analgesics, paracetamol, NSAIDs (including aspirin ≥300mg/day) and topical anti-inflammatories were recorded. Paracetamol was defined as optimised if a daily dose of 3-4g was prescribed and taken regularly (219). Concurrent use of anxiolytics and hypnotics (benzodiazepines and non-benzodiazepines) and adjuvant therapies, including gabapentinoids (pregabalin and gabapentin) and TCAs, were also evaluated.

A number of medical conditions have been associated with differences in opioid prescribing or risk factors in previous studies and these were reviewed. They included a history of falls (327), fractures (327), osteoporosis (448), congestive heart failure (CHF) (449), respiratory disease (450), history of substance or alcohol abuse (154, 229) and a history of depression and/or anxiety (154). Charlson Comorbidity Index (CCI) (451) was calculated for all patients. Pain was classified as either musculoskeletal pain or pain not otherwise specified (NOS) which included pain conditions or descriptions such as neuropathic/nerve pain, chronic pain, pain (unspecified).

Analysis was performed using SPSS Statistics 20 for Windows (SPSS Inc., Chicago, Il, USA). Chi-square analysis and Mann-Whitney U tests were undertaken to evaluate differences between patient groups. Ethics was granted from the Social Science Human Research Ethics Committee, University of Tasmania.

6.4 Results

Table 10 includes patient demographics. Analgesics (non-opioid and opioid), excluding topical anti-inflammatories, were documented as being taken by 15,823 (80.8%) patients reviewed;

6,235 (31.8%) reviews documented opioid use, with 4,334 (22.1%) patients taking RD opioids. Oral NSAID use was relatively low; meloxicam and celecoxib were the most commonly prescribed NSAIDs followed by ibuprofen, diclofenac and naproxen. Table 11 shows the use of analgesics for patients recorded as taking RD opioids; this table includes these patients' regular and as required medications. Of those patients taking RD opioids and anxiolytics/hypnotics, temazepam was most frequently used followed by diazepam, oxazepam and alprazolam; only 44.1% of those taking an anxiolytic or hypnotic had a documented history of anxiety and/or depression or insomnia.

There was no statistically significant association between the MEQ/d for RD opioid analgesics and a history of falls (p=0.88), fractures (p=0.73), osteoporosis (p=0.98), congestive heart failure (p=0.94) or respiratory disease (p=0.14). However, for people in ACFs, a history of osteoporosis increased the daily RD opioid dose (85.8mg versus 75.1mg p=0.037). People with a history of depression and/or anxiety had a statistically significant higher mean daily RD opioid analgesic dose compared with those without such a history (91.1mg versus 71.3 mg; p=0.003). Similarly people with a history of substance or alcohol abuse had a statistically significant higher mean daily RD opioid dose compared to those without a history of abuse (83.8mg versus 79.4mg, p=0.002). For people with a history of musculoskeletal pain the RD opioid dosage was 59.5mg compared to 55.9mg for those who did not have musculoskeletal pain (p<0.001). Pain NOS had significantly higher RD daily doses of opioids, than those who did not have pain NOS (76.9mg versus 51.6mg p<0.001).

Table 10 Demographics, medical conditions and analgesics used of the study population

Variable	Community n=12,272 (%)	ACF n=7309 (%)	Overall n=19581 (%)
Age in years (±SD)**	72.5±12.9	84.4±9.1	77.0±13.0
Male**	5136 (41.9)	2291 (31.3)	7427 (37.9)
Disease states			
History of cancer (excluding non-melanoma skin cancer)	1130 (9.2)	700 (9.6)	1830 (9.3)
History of musculoskeletal pain**	5627 (46.0)	2659 (36.4)	8286 (42.3)
History of pain not otherwise specified**	2019 (16.5)	829 (11.3)	2848 (14.5)
History of diabetes**	4420 (36.1)	1546 (21.2)	5966 (30.5)
History of CHF**	1030 (8.4)	899 (12.3)	1929 (9.9)
History of respiratory disease**	3436 (28.1)	1232 (16.9)	4668 (23.8)
History of depression and/or anxiety**	3193 (26.0)	2616 (35.8)	5809 (29.7)
History of substance or alcohol abuse	244 (2.0)	196 (2.7)	440 (2.2)
Average CCI**	1.7±1.7	1.9±1.5	1.8±1.7
Medications			
Taking analgesics (excluding topical anti-inflammatories)**	9189 (75.0)	6634 (90.8)	15823 (80.8)
Taking paracetamol**	8449 (69.0)	6446 (88.2)	14895 (76.1)
Taking optimised paracetamol**	2921 (23.9)	2905 (39.7)	5826 (29.8)
Taking an NSAID**	2353 (19.2)	435 (6.0)	2877 (14.7)
Using topical NSAIDs**	284 (2.3)	446 (6.1)	730 (3.7)
Taking an opioid analgesic**	3393 (27.7)	2842 (38.9)	6235 (31.8)
Taking an RD opioid analgesic**	2277 (18.6)	2057 (28.1)	4334 (22.1)
Taking an anxiolytic/hypnotic**	3388 (27.7)	3033 (41.5)	6421 (32.8)

Statistical analysis: comparing the analgesic usage between people in the community and people in ACF **p<0.001; *p<0.05

SD: standard deviation; CHF: congestive heart failure; CCI: Charlson Comorbidity Index; NSAID: non-steroidal anti-inflammatory drugs; RD: regularly dosed.

Table 11 Analgesic use for patients prescribed regularly dosed opioid analgesics

	Community n=2277 (%)	**ACF n=2057 (%)**	**Overall n=4334 (%)**
	Non-opioid analgesic use		
Paracetamol**	2011 (88.3)	1901 (92.4)	3912 (90.2)
Optimised paracetamol**	971 (42.6)	1155 (56.1)	2127 (49.1)
NSAIDs**	613 (26.9)	158 (7.7)	771 (17.8)
Using a topical NSAIDs**	66 (2.9)	194 (9.4)	260 (6.0)
	Opioid analgesic use		
Median MEQ/d (mg) RD opioid dose (range mg)^	36.0 (0.65-1180)	30.0 (2-853)	30mg (0.65-1180)
Mean MEQ/d RD dose*	58.6±80.9mg	56.9±78.0mg	57.8 ± 79.5mg
Buprenorphine patch**	499 (21.9)	895 (43.5)	1394 (32.2)
Oxycodone IR**	459 (20.2)	661 (32.2)	1121 (25.9)
Codeine containing**	809 (35.5)	270 (13.1)	1079 (24.9)
Oxycodone CR	508 (22.3)	474 (23.0)	982 (22.7)
Tramadol**	647 (28.4)	156 (7.6)	803 (18.5)
Fentanyl patch**	216 (9.5)	526 (25.6)	743 (17.1)
Morphine CR*	161 (7.1)	113 (5.5)	274 (6.3)
Morphine IR**	32 (1.4)	141 (6.9)	173 (4.0)
Other opioids^	182 (8.0)	214 (10.4)	396 (9.1)
	Other medications		
Laxatives/softener**	815 (35.8)	1698 (82.5)	2513 (60.0)
Anxiolytics or hypnotics**	945 (41.5)	996 (48.4)	1941 (44.8)
Taking an antidepressant*	1102 (48.4)	1066 (51.8)	2168 (50.0)
Taking an SNRI**	274 (12.0)	162 (7.9)	436 (10.1)
Taking a TCA**	378 (16.6)	177 (8.6)	555 (12.8)
Taking a gabapentinoid**	64 (2.8)	22 (1.1)	86 (2.0)

Note: Patients can appear in more than one row. The average number of opioid analgesics taken by each person documented as taking an RD opioid was 1.6 as this table include as required and RD opioid analgesics.
^ no statistical analysis was conducted on this variable
Statistical analysis: comparing the analgesic usage between people in the community and people in ACF **p<0.001; *p<0.05
NSAID: non-steroidal anti-inflammatory Drug; MEQ/d: morphine equivalence per day; RD: regularly dosed; IR: immediate release; CR: controlled release; SNRI: serotonin and noradrenalin reuptake inhibitor; TCA: tricyclic antidepressant

6.5 Discussion

Analgesic use was high in both the community and ACF population. Approximately 80% of the population were documented as taking at least one analgesic, although the indication for use could be for chronic, intermittent or incidental pain, with paracetamol and opioids most commonly used. The finding that 22% of the reviews recorded RD opioid analgesics clearly demonstrates the extent of opioid usage in older Australians and is consistent with the increasing number of opioid prescriptions being supplied in Australia (21, 23).

From Table 10 and 11 it can be seen there are substantial difference in the pattern of analgesics and adjuvant use between those in the community and those in ACFs. The use of NSAIDs was

low, particularly ACF residents which is in line with guidelines which tend to recommend caution when using NSAIDs in older people restricting their use to the lowest effective dose for the shortest period of time (108, 219, 313). TCA use was low in ACF residents, which is as expected based on guidelines recommending cautious use of TCAs due to the risk of side effects (108). For patients taking RD opioids, immediate release strong opioids (morphine and oxycodone) and patches (buprenorphine and fentanyl) were more frequently used in ACFs than the community, whereas in the community weak opioids (tramadol and codeine) were more commonly prescribed than in the ACFs. The use of CR oxycodone was similar in both groups, with a slightly higher proportion of community patients taking CR morphine than those in ACFs.

It is not unsurprising that the use of opioids in people with a history of depression and/or anxiety and those with a history of substance or alcohol abuse were higher and has previously been noted (154, 229). Falls, fractures or osteoporosis (excluding those in ACFs) were not associated with variations in RD opioid dosage, which was slightly surprising, as these have been associated with higher level of persistent pain (448, 452), however this does not seem to have corresponded to a higher level of opioid consumption in this cohort.

Overall paracetamol use was high with 90% of people prescribed regular opioids also taking paracetamol, however only 49.1% of these people were also taking optimised paracetamol, despite evidence suggesting that it improves pain control (453). It has been established that multimodal analgesic regimens in acute postoperative pain reduce opioid requirements (442), and it is likely that this approach would reduce opioid analgesic requirements in persistent pain also. Thus, it was encouraging to see that the levels of paracetamol use were higher in this study compared to previous Australian studies (379, 384, 452, 454); however, there is still significant room for improvement in this area.

There was extensive use of anxiolytics/hypnotics concurrently with RD opioids. Nearly 50% of ACF residents and 41.5% of community patients prescribed regular opioids were also prescribed anxiolytics/hypnotics. This is concerning given that anxiolytics and hypnotics are recommended for short term use and this combination, particularly in older people, further increases the risk of falls and fractures (327).

Despite guidelines recommending the prophylactic use of laxatives for people taking long-term opioids (108, 219, 313), only 60% of the population were using laxatives indicating potentially sub-optimal management of opioid-induced constipation, especially in community based

patients. Usage of laxatives was more common in ACF residents with only 35.8% of community-based patients taking laxatives with concurrent regular opioids.

Based on this research there appears to be a significant need for a pragmatic, quick reference guide for pain management in the elderly. Although the WHO are in the process of writing guidelines for the management of chronic non-malignant pain in adults (455), it is unclear the amount of detail that will be provided specifically talking about the management of pain in the elderly. As older people are at increased risk of adverse events from opioid analgesics, including confusion, respiratory depression, constipation, falls and fractures, which are compounded by high rates of comorbidities and polypharmacy, there is a need to ensure their pain is managed safely and effectively.

In addition, multiple guidelines exist with information about "good" candidate patients for opioids; however, they are often laborious to read and provide limited practical information on what other medications should be co-prescribed or at what dose. Thus, there is a need for a quick reference pharmacological guideline for the management of pain in the elderly, including the recommended steps, co-prescribed therapies (such as non-opioid analgesics and laxatives) and recommended doses, as well as additional relevant information, such as opioid analgesic trial durations. These guidelines should emphasis the optimisation of non-opioid analgesia before the addition or escalation of opioid analgesics and the regular use of laxatives in people taking regular opioids. Furthermore, there should be an associated increase in prescriber education in these areas, as well as the avoidance of concomitant anxiolytics and hypnotics in people taking opioids.

There are a number of strengths with this study, including the use of Australia-wide data, containing a comprehensive patient medical and medication history (including both over-the-counter and prescription medications). However, there is the potential that data may have been incorrectly entered by the pharmacists undertaking the review, which cannot be verified. There is also the potential that patients may take their medication differently to how it was documented in the medication review, which could both under- and over-estimate analgesic use. Unfortunately, the recommendations made by the pharmacists and which ones were implemented by the doctors was not recorded in the dataset; however, this would have helped inform the discussion around the QUM in this patient population. Finally, due to the way that data was recorded, neither the duration of opioid analgesic use nor the specific indication for the analgesic could be ascertained.

In conclusion, it is concerning to find suboptimal use of paracetamol in combination with RD opioid analgesics in older Australians with persistent pain. Furthermore, the widespread use of anxiolytics/hypnotics concurrently with opioid analgesics should prompt guidance in this area, given the associated increase in risk of falls and fractures.

A pragmatic, quick reference guide for the pharmacological management of persistent pain in older people is needed. It should emphasise the initial use of optimised non-opioid analgesia, highlight the risk of anxiolytics/hypnotics contributing to falls and fractures in people taking opioid analgesics, and the need for concurrent laxatives in people taking regular opioids. This strategy has the potential to improve care through better pain control whilst at the same time minimising the risks associated with opioid analgesics in older people, where the burden of persistent pain is significant.

Chapter 7: Pharmacological management of pain in Australian aged care facilities

All of the research contained within this chapter has been published as Veal FC, Bereznicki, LR, Thompson AJ, Peterson GM, "Pharmacological management of pain in Australian aged care facilities", *Age and Ageing*, 2014: **43** (6) pp. 851-856. doi:10.1093/ageing/afu072

7.1 Abstract

Background: Up to 80% of residents in ACFs experience pain, and previous studies have found that older patients with pain are often undertreated. Few studies have been conducted in Australia evaluating the use of analgesic therapy in ACF residents.

Objective: To explore the use of analgesics amongst ACF residents, including independent predictors of analgesic use, evaluate analgesic use against pain management guidelines and identify potential medication management issues.

Methods: A retrospective analysis of 7,309 medicines reviews conducted on Australian ACF residents was undertaken. Medication use was compared with published guidelines relating to the management of pain in elderly patients or ACF residents. Multiple variable logistic regression was used to identify independent predictors of analgesic use.

Results: Nearly 91% of residents were prescribed analgesics. Of those, 2,057 residents were taking regular opioids (28.1%). Only 50% of those taking regular opioids received regular paracetamol at doses of 3-4g/day. The concurrent use of sedatives was high, with 33.3% of those taking regular opioids also taking an anxiolytic/hypnotic.

Conclusion: There is a need to optimise the prescribing and administration of regular paracetamol as first line and continuing therapy for pain management in ACF residents, to potentially improve pain management and reduce opioid requirements. Furthermore, with the risk of falls and fractures increased by concurrent use of opioids and sedatives, the widespread use of these drugs in a population already at high risk was concerning, indicating a need for better education of health professionals in this area.

7.2 Introduction

Pain in the elderly is a common issue, with up to 80% of residents in ACFs experiencing persistent pain (444). Despite persistent pain being recognised as a major cause of disability in elderly patients, significant under-treatment in this population has been reported (449, 452, 456, 457).

Age-related changes affect how the elderly experience pain, including a reduced production of endogenous analgesic substances and changes in pain perception (100, 101). Furthermore, there is greater heterogeneity in the way older patients respond to medications, including analgesics (16). This is partly attributable to pharmacokinetic and pharmacodynamic changes (108), but also to comorbidities that potentially affect the response to analgesics (109).

A number of guidelines relating to the management of pain in elderly patients or ACF residents exist. Generally, these recommend regular (by-the-clock) dosing of analgesics for patients with persistent pain (219), with paracetamol recommended as the first line option (108) (1g 6-hourly) (219) and continued as a baseline analgesic when more potent agents (e.g. opioids) are added (16, 219). The use of weak opioids in the management of both cancer pain and chronic pain has been debated, with some suggesting that low dose strong opioids are a more suitable alternative after non-opioid analgesics have failed to adequately manage pain alone (458). Guidelines also recommend that, due to the risk of side effects, NSAIDs should be avoided if possible, or used at the lowest effective dose for the shortest period of time (108, 219). Potentially, these restrictive recommendations make guidelines difficult to follow in practice, leaving prescribers with relatively few options to treat pain amongst elderly patients.

Another complication when treating pain in the elderly is the prevalence of comorbidities and high rates of polypharmacy, increasing the risk of adverse drug events. Certain types of pain (459), as well as some analgesics, have been implicated in increasing the risk of falls (327, 459). With the consequences of falls and fractures being so significant in the elderly, it is challenging for clinicians to minimise this risk whilst still adequately controlling pain.

In Australia few studies have been undertaken to evaluate the use of analgesics in ACF residents (382-384). With limited options to manage pain in this group and multiple conflicting treatment priorities, this study aimed to investigate pain management practices in ACFs, identify patient factors that increase the likelihood of analgesic use, and examine any medication management issues.

7.3 Methods

ACFs in Australia provide a range of support from high dependency (nursing home) to low dependency (residential homes). Residents from both high and low dependency care have been included in this review. The Australian Government funds biennial RMMRs by accredited pharmacists for any Australian residents who live permanently in an ACF, to attempt to reduce the occurrence of drug-related problems. Several different software programs exist to aid pharmacists with handling data obtained during their review, assessing medications and writing reports; one of which is Medscope™. It is estimated that 20-25% of all reviews conducted in Australia involve use of this software system. The Medscope™ database includes basic demographic details, prescription and over-the-counter medications (including prescribed dose and directions) and brief medical history, which are entered by the pharmacist conducting the review. De-identified data from all RMMRs recorded in the database between January 2010 and June 2012 were extracted from Medscope™ and were included in the study. There were 33 reviews that had no documented medical history and these were removed from the analysis, leaving 7,309 reviews.

Analgesics evaluated in this study, included paracetamol, NSAIDs (including aspirin at doses ≥300mg/day) and opioids. Opioids were classified as being taken as a RD or not (if taken on an as required basis). Oral MEQ per day was calculated (299). Opioids used predominantly as antitussives (dihydrocodeine or pholcodine), or codeine linctus with a direction indicating that its use was for cough or diarrhoea, were not included as analgesics. The following opioids were classified as weak: tramadol, codeine and dextropropoxyphene; with morphine, oxycodone, fentanyl, buprenorphine, methadone and hydromorphone classified as strong opioids. Paracetamol was defined as being optimised if the daily dose was 3-4g and given by-the-clock. Anxiolytics/hypnotics were defined as benzodiazepines and non-benzodiazepines hypnotics (zopiclone and zolpidem); other sedating agents (antidepressants, antipsychotics and sedating antihistamines) were also recorded.

In ACFs, residents have their medication managed by nursing staff in multidrug blisters, packed by pharmacies. For this reason prescribed doses for RD medications are likely to reflect medications administered to the patient. However, for “as required” medications, the dose and frequency administered to the patient is not specified in the database.

The CCI (451) score was calculated for each patient. Pain was classified into musculoskeletal pain, which included the following conditions: back pain, joint pain, spondylosis and osteoarthritis; and pain NOS, which included the following medical descriptions noted in the medical history: “pain”,

"chronic pain", neuropathic pain, nerve pain, post-herpetic neuralgia, fibromyalgia, and headache, migraine. Other chronic medical conditions previously noted to be associated with different patterns of pain or increased usage or risk of problems associated with analgesics (particularly opioids) were also determined, including a history of substance abuse (154), depression and/or anxiety (154), falls (327), dementia (460), Parkinson's disease (461), diabetes (461), chronic obstructive pulmonary disease (COPD) (450), stroke (462), CHF (449), osteoporosis (448) and fractures (452).

Statistical analysis was performed using SPSS Statistics 20 for windows (SPSS Inc., Chicago, Il, USA). Chi-square, Mann-Whitney U and Wilcoxon Signed Rank tests were undertaken to evaluate differences between patient characteristics and analgesic use. Multiple variable binary logistic regression was subsequently used to analyse the independent associations between non-injectable analgesic use and patient demographics, co-prescribed therapies and comorbidities. All variables with P values <0.1 were assessed for multicollinearity prior to inclusion in the multiple variable binary logistic regression model.

7.4 Results

The majority of residents were women (68.7%), with an average age of 84.4 years (±9.1) and an average CCI score of 1.9 (±1.5). Analgesics were prescribed to 6,634 of the residents; 2057 (28.1%) residents were prescribed RD opioids (86.5% of opioids were strong opioids; 9.5% weak opioids and 4.0% both strong and weak opioids). Of those residents taking RD opioids, 1155 (50.1%) residents were taking optimised paracetamol. There was no significant difference between the CCI score of those prescribed analgesics and those not (p=0.50). However, there was a small, but statistically significant difference, in the CCI score between those taking RD opioids and those not (1.97 v 1.87; p=0.01).

Table 12 shows the pattern of all analgesics used in the study population. Non-opioid analgesics only were prescribed to 3793 (51.9%) residents, with 2676 (36.6%) residents prescribed both non-opioid and opioid analgesics. Table 13 shows the proportion of each opioid prescribed; the majority of opioids prescribed to residents were strong opioids (80.6%), with weak opioids accounting for 19.4% of opioids prescribed. The mean dose of RD opioids was 57.8mg MEQ/d (±79.5mg) and the median dose of RD opioids was 30mg MEQ/d. There was no statistical difference between the RD opioid dose of those with a history of falls and those without (p=0.50). The use of TCAs was low, with 402 (5.5%) residents prescribed a TCA and 177 residents prescribed RD opioids concurrently prescribed a TCA. Gabapentinoids were infrequently

prescribed, with only 36 residents prescribed one; 23 residents were prescribed concurrent RD opioids and a gabapentinoid.

Anxiolytics/hypnotics were prescribed to 41.5% of the residents, with 43.2% and 32.8% of those taking analgesics and RD opioids, respectively, also prescribed these sedative drugs. There was no statistical difference between the MEQ/d for those on RD opioids who were taking an anxiolytic/hypnotic and those not (p=0.19). Of those patients prescribed anxiolytics/hypnotics, 55% did not have a documented history of insomnia or anxiety/depression.

Table 14 shows the likelihood of residents being prescribed analgesics, non-injectable opioids, RD opioids and optimised paracetamol. Opioids were more likely to be prescribed to females, and those with a history of musculoskeletal pain, pain NOS, history of fractures, osteoporosis or taking anxiolytics/hypnotics or other sedating agents. Patients taking opioids or RD opioids were more likely to have a history of cancer; RD opioids and optimised paracetamol were more likely to be taken by patients with a history of CHF. Patients with dementia were less likely to receive optimised paracetamol, opioids or RD opioids.

Table 12 Use of all analgesics

Type of analgesia	**Resident taking analgesics n (%)**	
Regularly Dose opioids	**2057 (28.1)**	
Opioid + optimised paracetamol	1155 (15.8)	102 (1.4) also administered NSAIDS
Opioid + paracetamol	746 (10.2)	51 (0.7) also administered NSAIDS
Opioid only	153 (2.1)	
Opioid + NSAID	7 (0.1)	
As required opioids	**785 (10.7)**	
Opioid + optimised paracetamol	395 (5.4)	22 (0.3) also administered NSAIDS
Opioid + Paracetamol	373 (5.1)	29 (0.4) also administered NSAIDS
Opioid only	14 (0.2)	
Non-opioid analgesia only	**3793 (51.9)**	
Paracetamol only	2427 (33.2)	102 (1.4) also administered NSAIDS
Optimised paracetamol only	1352 (18.5)	102 (1.4) also administered NSAIDS
NSAID only	14 (0.2)	
No analgesics	**674 (9.2)**	

NSAID: non-steroidal anti-inflammatory drugs

Table 13 Use of opioids

Opioid	Number of those taking opioids	Percentage of those taking opioids*	Proportion of the study sample
Buprenorphine patch	898	31.6	12.3
Codeine ± combination	560	19.7	7. 7
Controlled-release morphine	96	3.4	1.3
Controlled-release oxycodone	483	17.0	6.6
Fentanyl patch	520	18.3	7.1
Immediate-release morphine	310	10.9	4.2
Immediate-release oxycodone	1028	36.2	14.1
Morphine injection	238	8.4	3.3
Other	105	3.7	1.4
Tramadol	252	8.9	3.5

* Equals more than 100% as the average number of opioids used per resident (using opioids) was 1.9.

Table 14 Associations with analgesic usage

	Any analgesia (odds ratio 95% CI)	**Any non-injectable opioids (odds ratio 95% CI)**	**RD opioids (odds ratio 95% CI)**	**Optimised Paracetamol (odds ratio 95% CI)**
Age				
<60	1	1	1	1
60-<70	0.39 (0.19-0.80)*	1.01 (0.65-1.56)	0.88 (0.55-1.43)	0.91 (0.57-1.47)
70-<80	0.67 (0.34-1.31)	1.23 (0.83-1.84)	1.00 (0.65-1.55)	1.02 (0.67-1.57)
80-<90	0.65 (0.34-1.27)	1.05 (0.71-1.55)	0.93 (0.61-1.41)	0.92 (0.60-1.40)
≥90	0.94 (0.48-1.85)	1.11 (0.75-1.64)	0.95 (0.62-1.45)	0.92 (0.60-1.40)
Female	1.20 (1.01-1.42)*	1.21 (1.08-1.35)*	1.38 (1.21-1.56)**	1.35 (1.19-1.52)**
Depression	1.00 (0.84-1.22)	1.04 (0.93-1.16)	1.00 (0.89-1.21)	1.11 (1.00-1.24)
History of Falls	-	-	-	0.99 (0.78-1.04)
CCI	-			-
0-1		1	1	
2-3		1.12 (1.00-1.26)	1.11 (0.98-1.26)	
4-5		1.01 (0.83-1.22)	1.00 (0.82-1.23)	
≥6		1.15 (0.82-1.62)	1.10 (0.77-1.58)	
Dementia	-	0.75 (0.66-0.84)**	0.68 (0.60-0.76)**	0.71 (0.64-0.79)**
Asthma	1.29 (0.88-1.88)	1.06 (0.86-1.31)	1.10 (0.88-1.12)	1.14 (0.92-1.40)
Parkinson disease	-	0.87 (0.71-1.07)	0.80 (0.64-1.01)	-
CHF	-	1.11 (0.94-1.29)	1.23 (1.04-1.46)*	1.25 (1.07-1.47)*
Stroke	0.65 (0.41-1.04)	-	-	-
COPD	-	1.06 (0.90-1.29)	1.08 (0.90-1.30)	-
Anxiolytics/ hypnotics	2.28 (1.90-2.75)**	1.70 (1.53-1.88)**	1.41 (1.27-1.58)**	1.48 (1.33-1.64)**
Other sedating agents	1.21 (1.02-1.44)*	1.34 (1.23-1.56)**	1.49 (1.33-1.68)**	-
Musculoskeletal	1.90 (1.57-2.30)**	1.63 (1.47-1.80)**	1.63 (1.46-1.82)**	1.62 (1.45-1.80)**
Pain NOS	1.93 (1.38-2.69)**	2.26 (1.94-2.64)**	2.44 (2.09-2.85)**	2.45 (2.10-2.85)**
Osteoporosis	1.24 (0.98-1.58)	1.29 (1.14-1.46)**	1.22 (13.07-1.40)**	1.21 (1.06-1.38)*
Fractures	1.92 (1.39-2.66)**	1.60 (1.38-1.86)**	1.54 (1.32-1.80)**	1.56 (1.34-1.82)**
Falls Risk	-		-	-
0		1		
1		0.84 (0.71-1.00)*		
2		0.70 (0.58-0.85)**		
≥3		0.67 (0.53-0.83)**		
History of cancer	-	1.32 (1.10-1.60)*	1.38 (1.13-1.68)*	-

* P<0.05; ** P ≤ 0.01

7.5 Discussion

Previous studies have noted low use of analgesics in elderly patients (449, 452, 456, 457). This study found that the vast majority (90.7%) of residents were prescribed an analgesic (62.8% taking analgesics regularly), which is considerably higher than the level of analgesic use found in a previous Australian study (384). This increase could be partially attributed to the Australian Pain Society's Guidelines on the management of pain in ACF (219) being released in 2005, increasing awareness of the management of pain in the elderly. Potentially the patients in our

study may have also been seen by pharmacists previously for a review in an attempt to improve pain management. Consistent with other studies (449, 452), we found that paracetamol was the most commonly prescribed analgesic. However, the use of optimised paracetamol was low, only being prescribed to 40% of residents overall and 50% of those patients on RD opioids, which are similar rates to those found in other studies (452). The use of NSAIDs was low, which is in line with clinical guidelines (108).

Three major medication issues were identified in the study: (i) low use of optimised paracetamol, particularly in patients who were taking RD opioids; (ii) high use of anxiolytics/hypnotics in combination with opioids, which substantially increases the risk of falls and fractures; and (iii) potentially sub-optimal management of pain in patients with dementia. Although the safety of paracetamol at therapeutic doses has recently been questioned by some (463), it is generally regarded as the safest option available for elderly patients and is recommended by guidelines (16, 108) as a first line option for pain management. The use of regular paracetamol at an appropriate dose was low, particularly in patients taking RD opioids. This is consistent with a recent Australian study (382) evaluating oxycodone use in a similar population, which found that only 41% of residents of ACFs had had a trial of a non-opioid analgesic prior to commencing oxycodone. These findings suggest that the use of paracetamol in chronic pain needs to be given prominence in clinical guidelines, particularly as a means to minimise use of opioids, their associated side effects and improve pain management. There may be a place for regulatory bodies, which approve and monitor long-term opioid therapy, to require maximum tolerated doses of paracetamol be used before the addition, or dose escalation, of opioids.

The second issue was the use of anxiolytics/hypnotics in combination with opioids, both of which increase the risk of falls and fractures (327, 329, 464). The combination is not recommended, particularly in the elderly, due to falls risk (465). It appears that warnings about the danger of combining sedating agents, such as anxiolytics/hypnotics with opioids, are not being heeded. There is a need to increase the education of health professionals about such combinations in an attempt to minimise their use, whilst still addressing the requirement for adequate pain relief.

The third issue identified was the low use of analgesics in patients with a history of dementia, which has been identified previously (460). Potentially, this may indicate judicious use of medications, in that these patients have high potential to develop adverse events with opioids (466). However, it is unlikely that these patients experience less pain than their counterparts without dementia (460), and the low level of optimised paracetamol and opioid use in this group, indicates that patients with dementia are likely to have sub-optimal pain management. Increased

emphasis of regularly dosed analgesics, particularly paracetamol, in patients with dementia should be encouraged if pain is suspected. This is particularly important in patients with a history of dementia, as often these patients are unable to request or adequately communicate pain and thus regular dosing of analgesics is essential to assist in managing the patient's pain.

The pattern of opioid use in published studies is highly variable. Nearly 40% of the residents reviewed in our study were documented as receiving opioids, which is consistent with some other studies (383, 452), but not all (461). Of those taking opioids, 72.4% were taking opioids regularly, which is higher than previously reported (384). There was also greater use of strong opioids than previously noted (449), accounting for 80.6% of opioids prescribed. However, the use of weak opioids was still relatively high, potentially indicating prescriber's concerns over the use of strong opioids in this patient group or perceived efficacy. As the trial evidence to support the use of weak opioids is difficult to extrapolate to clinical practice (458) this use may be justified and suitable in these patients.

Not surprisingly, musculoskeletal pain, pain NOS, fractures and osteoporosis were the most likely independent factors associated with analgesic use. Residents with a history of CHF were more likely to use RD opioids and optimised paracetamol, in contrast to another study (449) that found ACF residents were less likely to receive opioids if they had a history of CHF. Potentially this increased use of opioids reflects the avoidance of NSAIDs in patients with heart failure as well as increased acceptance of the use of opioids for persistent pain in elderly patients.

There are some limitations associated with this dataset. Unfortunately, the recommendations made by the pharmacists and which ones were implemented by the doctors, as well as non-pharmacological management strategies employed were not recorded in the dataset; however, this would have helped inform the discussion around the QUM in this patient population. The clinical indications for analgesic use, cause of pain or satisfaction with pain management were not able to be determined from the data. In addition, medications were listed with their prescribed directions rather than administered dose, which is particularly relevant to medications given on an 'as required' basis, and therefore we may have underestimated the extent of use of these medications. However, as the vast majority of ACFs use pharmacist-prepared medication packs administered by nursing staff, the prescribed dosages for RD medications are likely to represent the actual usage. There is the potential that pharmacists may be more likely to use decision support software where patients are more clinically complicated. However, chronic pain is difficult to manage and these patients tend to have multiple comorbidities, for this reason it is expected that the results from this study are consistent with

analgesic use in Australian ACFs. Despite these limitations, this data still has some significant strengths, including the large patient population throughout Australia, no recall bias, and the inclusion of both prescription and over-the-counter medication. In addition, this sample appeared to be broadly representative of Australian ACF residents, which is not unsurprising noting that the vast majority of residents in ACFs undergo a medicines review

In conclusion, three medication management issues were identified: low rates of optimised paracetamol use, particularly in patients taking regular opioids; high concurrent use of anxiolytics/hypnotics with opioids; and potentially inadequate pain management in patients with dementia. The risk of falls and fractures with opioids is a strong reason to encourage the prescribing and administration of regular paracetamol at a dose of 3-4g/day, before the addition or uptitration of opioids, particularly when the patient is also taking sedating agents. It is clear there is a need for increased education of ACF staff and medical practitioners in an attempt to minimise potentially risky combinations of sedating agents. There is also a need to emphasise that optimised paracetamol should be used as a baseline and ongoing analgesic in the management of pain. In addition, regulatory bodies could have a role to play in requiring paracetamol to be prescribed at an optimised dose as a baseline analgesic before approval for long-term opioids is granted.

Chapter 8: The barriers to pain management in Tasmanian general practice

8.1 Abstract

Background: Pain is difficult to manage and is often both under and over treated. Numerous factors complicate treatment, including poor trial evidence of analgesics in long-term use, safety and addiction concerns regarding opioids and patient factors. This study aimed to identify how GPs in Tasmania manage pain and what the perceived barriers to pain management within Tasmania are.

Methods: An electronic survey was distributed to Tasmanian GPs between November and December 2015. Publically available email addresses of GP practices were used when available, and all general practices that could be identified through an online search were contacted to request an email address. Information about the survey was also distributed in November 2015, via the Primary Health Network newsletter, which is electronically distributed to all Tasmanian General Practices.

Results: 41 surveys (5.6%) were completed. The median number of years practicing as a GP was 17.5 (range: 2-49). The median number of patients experiencing pain, seen each week was estimated to be 20 (range 3-56). The major barriers to pain management were identified as poor access to pain clinics and allied health services, analgesic adverse effects, and unrealistic patient expectations. Participants also suggested that pain management could be improved through additional education for health professionals and patients.

Conclusion: There are a number of health system barriers to optimal pain management. Strategies that require significant policy change and Government cost are required, however, they will take time to implement. More immediate methods of improving pain management could include additional patient and prescriber education.

8.2 Introduction

Acute pain, which has an identifiable cause, is more straightforward to treat than persistent pain, where the cause of the pain is not always so clear. The evidence to support the use of analgesics in acute pain is good (48) and treatment options are dependent on patient comorbidities and co-prescribed therapies. In contrast, persistent pain is a challenging condition to treat, with poor evidence to support the use of analgesics long-term (89, 228, 303), common misconceptions amongst patients regarding pain and its management (467, 468), the want for a 'quick fix' (469, 470), and the lack of public funding for allied health services (471) and pain clinics (472).

Guidelines recommend that persistent pain should be managed by a multidisciplinary team in order to improve patient outcomes and function (473). However, the vast majority of consultations regarding persistent pain management occur in general practice (1, 2) and it has been reported that over one third of all GP appointments involve patients with persistent pain conditions (474). The prevalence of conditions associated with persistent pain are increasing (475), due in part to an ageing population, longer term survival following cancer diagnosis and an increased number of surgical procedures, after which some patients develop PPP. The complexity of the issues facing patients with persistent pain pose particular challenges to GPs, when a standard Medicare Benefits Schedule (MBS) funded GP appointment typically lasts only 12 to 14 minutes (476).

Some information is known about prescribing of analgesic in Australian general practice. The studies that have been conducted have used data from the Bettering The Evaluation And Care of Health (BEACH) program, which was a now defunct longitudinal cross-sectional program surveying approximately 1250 Australian GPs annually, documenting 100 consecutive consultations each (477). These studies have identified analgesic prescribing rates, indications for prescribing, use of non-pharmacological strategies, and how frequently patients are provided advice and sent for pathology or other tests (10, 478-480). However, BEACH data is unable to provide information about the barriers and enablers to pain management, or specifics surrounding guidelines and what information is provided to patients.

Numerous barriers to optimal persistent pain management in general practice have been identified internationally. One study from the United Kingdom found that GPs identified the main barriers to optimal pain management as: adverse effects, patient compliance, and efficacy of medications (481). A qualitative British study (482) identified a number of barriers including: feeling underprepared to manage persistent pain patients; poor evidence around opioids making management plans difficult to formulate; an absence of shared treatment goals; patient reluctance to use non-pharmacological strategies; pain being relegated in favour of acute problems; and a reluctance to deprescribe opioids. Another qualitative British study (77) found that GPs often felt ill-equipped to assessing the level of pain, felt they had low levels of training on the area and demonstrated a more conservative approach to prescribing compared to prescribing in cancer pain. One American study reported that the major barriers to pain management were uncertainties about best treatment options, the biopsychosocial nature of persistent pain, risk of abuse, and the limited time available to manage persistent pain (483). Additional factors were identified by another American study, which found that inadequate training, low satisfaction with the management of pain, and patient-related aspects including

patient psychology, self-management and compliance were barriers to management (474). However, with healthcare funding models, service availability and accessibility and legislation varying from country to country, it may not be appropriate to apply the international literature to the Australian context. Consequently, this study aimed to identify how persistent pain is managed by GPs in Tasmania, the perceived barriers to optimal pain management, and potential ways in which these could be overcome.

8.3 Methods

An electronic survey was distributed to the Tasmanian general practice community through a variety of channels. The local Primary Health Network published information about the survey in their electronic newsletter, which is distributed monthly to all GP practices in Tasmania. In addition, contact details for general practices in Tasmania were obtained through an extensive Internet search. For those practices where an email address was not publicly available, the practice was contacted by phone to obtain an email address so that the survey could be distributed to the GPs at the practice. If the practice preferred, the information sheet and link to the survey was provided by fax or hard copy in the mail. All attempts to contact all GP practices in Tasmania was made. At the time of the study, there were 698 practicing GPs in Tasmania (484). Ethics approval was granted by the Tasmanian Health and Medical Research Ethics Committee. An incentive was used to enhance recruitment, which was the chance to win one of five $100 AUD gift cards.

The survey (Appendix 7) was conducted through Lime Survey (485). Participants were asked how many years they had worked in general practice; on average how many patients they saw each week with acute pain, persistent pain (both non-malignant and malignant), palliative care and neuropathic pain. Participants were also asked questions regarding guideline(s) used to inform management of pain, perceived barriers to pain management in general practice and how these could be overcome. Tick box responses were required for most questions with the option to annotate responses with free text. The tick box options were based on previously recorded factors influencing pain management, compliance or barriers. The question regarding ways to overcome barriers to pain management was entirely free text. Free text answers were subsequently categorised into themes.

8.4 Results

Fifty-eight participants commenced the survey, with 41 completing the survey. The median number of years practicing as a GP was 17.5 years (range: 2-49 years). The median number of patients experiencing pain, seen each week was estimated to be 20 (range 3-56). Table 15 provides further information about the types of pain managed by GPs on a weekly basis.

Therapeutic Guidelines (Analgesic) (240) was most commonly used by GPs to guide their pain management (68.3%); followed by the WHO pain ladder (217) (36.6%); and the Royal Australian College of General Practitioner's guideline for the non-surgical management of hip and knee osteoarthritis (313) (31.7%). A small minority of GPs used other guidelines. One GP used "clinical judgment" and one GP said that they did not use guidelines rather they said "… I make it up as I go". Table 16 provides information about the strategies used by GPs to manage pain, particularly when using opioids.

Table 15 Number of patients seen by GPs each week with different types of pain (n=41)

Type of pain	**Median number of patients/week (range)**
Acute pain	5 (1-25)
Persistent non-malignant pain	5 (1-30)
Persistent malignant pain	1 (0-5)
Palliative care	1 (0-30)
Neuropathic pain	4 (0.5-15)

Table 16 Strategies used by GPs in the management of pain (n=41)

Strategy	**n (%)**
Discussion around pain management expectations	30 (73.2)
Opioid trials of ~8 weeks	20 (48.8)
Urine drug screening to monitor compliance and inappropriate drug taking	5 (12.2)
Referral for CBT	11 (26.8)
Referral for physiotherapy	31 (75.6)
Regular reviews of the 5As (analgesia, activity, adverse events, aberrant behaviour and affect)	10 (24.3)

CBT: cognitive behaviour therapy

Table 17 provides information about the perceived patient compliance to analgesics by GPs. The most common reasons that GPs thought patients were non-compliant were: poor analgesics efficacy (76.5%), fear of addiction (61.8%), reserving analgesics for severe pain (58.8%), tablet burden (55.9%), fear analgesics will not work if they use them too often (50.0%), pain catastrophising (50.0%), fear of pain (41.2%), misuse or diversion (32.4%), and lack of patient knowledge (8.8%).

Table 17 Percentage of GP's who perceive patients are adherent or non-adherent to analgesics (n=34)

	Acute pain		
	Less than Prescribed	As prescribed	More than prescribed
Paracetamol	22 (64.7)	8 (23.5)	4 (11.8)
NSAIDs	13 (38.2)	14 (41.2)	7 (20.6)
RD opioids *	4 (12.5)	24 (75.0)	4 (6.3)
PRN opioids	7 (20.5)	15 (44.1)	12 (35.3)
	Chronic/persistent pain		
	Less than Prescribed	As prescribed	More than prescribed
Paracetamol	23 (67.6)	10 (29.4)	1 (2.9)
NSAIDS*	12 (37.5)	15 (46.9)	5 (15.6)
RD opioids **	0 (0)	27 (81.8)	6 (18.2)
PRN opioids***	4 (12.9)	9 (29.0)	18 (54.5)
Adjuvants **	4 (12.1)	27 (81.8)	2 (6.5)

Note: * two participants did not respond to this aspect; **one participant did not respond to this aspect; *** three participants did not respond to this aspect.
NSAIDs: non-steroidal anti-inflammatories; RD: regularly dosed; PRN: as required

Major barriers to optimal pain management could be classified into four themes: patient factors, medication factors, pain condition related factors and healthcare system factors. Healthcare system factors were the most frequently cited as barriers to optimal pain management. Specific examples included waiting times for and access to pain clinics, limited government funding of allied health professions (psychologists and physiotherapists), surgical waiting times and lack of support for GPs. Patient factors cited as barriers included unrealistic patient expectations, patient psychology (for example, psychological comorbidities and coping strategies) and a reluctance to use non-pharmacological or self-management strategies. Medication factors included the risk of misuse or diversion, adverse effects, lack of efficacy, lack of evidence, and guidelines that are difficult to use. Pain-related factors included difficulties in terms of diagnosing causes of persistent pain and the complexity of pain management.

Multiple suggestions were made regarding ways to overcome these barriers. The most common of these were: better access to pain clinics or support of GPs by pain clinics, improved access to allied health care professionals (including physiotherapy, psychology and multidisciplinary teams), and increased education of patients, GPs and allied health care professionals. Improved management of acute and post-surgical discharge pain, better and simpler guidelines, and increased time available to manage patients with pain were also noted as desirable by some GPs.

8.5 Discussion

This is the first study we are aware of that has surveyed Australian GPs regarding the barriers to optimal pain management in general practice. A number of factors identified by Australian GPs

were similar to those in international studies, including medication and patient-related aspects. However, the most commonly cited barriers in this study were related to health system factors. GPs identified that major barriers to optimal pain management were a lack of access and long waiting times for pain clinics, and a lack of government funding for allied health professionals to assist in multidisciplinary management of patients with persistent pain.

These are not factors that have been previously identified in international studies and this may reflect differences in the health systems and funding models in place other countries. However, other Australian studies have reported that the health system poses barriers to optimal management of patients with cancer or palliative care related pain. These included difficulty in accessing non-pharmacological management options and a lack of coordination between different services (486-488). These factors do appear to be consistent across a number of health care providers (including specialists, community nurses and GPs) and in different pain management settings (including cancer pain and palliative care).

Long waiting times for multidisciplinary pain clinics in Australia have also been identified previously (472). This is an area that requires additional policy change and financial support, although the most cost-effective way to improve access requires further investigation. A number of initiatives to improve pain clinic access and pain management in this area have been implemented in Australia (35, 489). Pain clinics are primarily funded by individual states and territories and, increased resources would be required at this level to improve the management of pain. If this is financially unviable, then potentially empowering GPs by increasing the support and assistance provided by pain clinics may be a more cost-effective approach. This could be undertaken through improving GP access to the expertise of pain specialists, who may be able to advise on management strategies for difficult cases via phone or email. Additionally, it would take significant policy changes and increased Commonwealth funding to increase the MBS subsidy of physiotherapy and psychology to assist in the multidisciplinary management of pain.

Another key area identified as having the potential to improve patient management was increased education of GPs and allied health care professionals. This could be undertaken through increased continuing professional development (CPD) in pain management and increased availability of pain management related post-graduate courses. A number of courses are already available (35, 490, 491) but require medical professionals to undertake these activities in their own time. Further incentives may be required to increase the number of GPs with additional training in pain management. If these types of initiatives were expanded to include other health care professionals this could further assist with efforts to improve pain management. However, there is also a need for an increased focus on pain management in

undergraduate courses for allied health care professions, not solely medicine. This has previously been identified as an area where GPs believe they have insufficient grounding and assessments of undergraduate medicine curriculum have identified deficiencies (474, 492, 493). Although there has been a recent increased emphasis on training early career doctors (494) this needs to be introduced earlier into doctors' training. A concerted effort from all Australian universities would be required to better integrate pain management into the curriculum of medical undergraduate and graduate courses as well as allied health profession degrees. This is likely to have significant long-term benefits, although it would presumably take many years before the impact of this would be seen in clinical practice.

Barriers related to the poor evidence base, adverse effects and difficult to use guidelines (which in part is due to the poor evidence base) are difficult to overcome completely. Patient-related barriers to optimal pain management may be overcome, to some extent, through improved patient education around pain management, expectations, and the role of analgesics and self-management strategies. Although a number of initiatives exist which focus on improving patient knowledge and public awareness of pain and its management, particularly by Chronic Pain Australia (35), there may be room for further development of these. Focus groups and interviews with patients may allow for further insight into what type of information patients want and how they would prefer it to be delivered in the Australian context.

Another potential approach, although not explicitly mentioned by the GPs, is to expand the role of pharmacists to allow for more patient education. This has been previously suggested in Australia (495) as well as internationally (496, 497). This could be through accredited pharmacists who visit patients in their home to carry out HMRs or pharmacists who work in GP clinics, a program which is likely to be expanded over the coming years (498). Pharmacist led interventions, including educational programs (499), medication reviews (500), and pharmacist-nurse led pain clinics (501) have been found to reduce adverse events and pain intensity, as well as improve physical functioning and patient satisfaction. Increased collaboration between GPs and pharmacists may provide opportunities to improve patient outcomes and also reduce the burden of pain management on GPs.

BEACH data found that approximately 20% of patient episodes, with new onset pain conditions were provided with advice about their pain management, although what the content of the advice was, is not specified (478, 479). Whereas, 73.2% of the GPs in thus study reported talking to patients about expectations, which is a positive finding (although it was not recorded how frequently GPs conducted these discussions with patients). Without such discussions, patients may assume that freedom from pain is achievable and that once an analgesic is started for

persistent pain it will be automatically be continued. Nonetheless, it is concerning to see that only half (48.8%) of the GPs participating in the survey use opioids trials. For persistent pain, opioids often to do not decrease the level of pain substantially or improve physical function (502) and opioid trials are recommended to ascertain benefit and adverse events (18, 503, 504). This is an area that requires increased emphasis and is closely aligned with patient expectations. Without discussion surrounding a trial of an opioid, any subsequent desire to deprescribe may become more challenging. Approximately one quarter (24.3%) of doctors regularly reviewed the 5As (analgesia, activity, adverse events, aberrant behaviour and affect) with patients. To a substantial degree, these results are likely reflective of the significant time constraints on GPs. While increased involvement from nurse practitioners or pharmacists working in general practice may assist in managing some of these aspects, increasing the ability for GPs to spend more time with complex pain patients would be the optimal option. However, this may not be feasible given the fee-for-service model and commercial pressure on GPs to see more patients. Discussions around treatment trials and expectations could, however, be supplemented by additional patient information and education.

The guidelines or recommendations most frequently reported being used by GPs were the Therapeutics Guidelines, the WHO pain ladder and the Royal Australian College of General Practitioner's guideline for the non-surgical management of hip and knee osteoarthritis. Nonetheless, it is important to note that previous BEACH data indicated that GPs do not necessarily treat patients in accordance with guidelines (478). Although most (95%) GPs reported using guidelines in their management of pain, it is concerning that no GPs referred to the use of document 'Pain in Residential Aged Care Facilities' (219) produced by the Australian Pain Society, despite this being considered to be a definitive pain management resource by the Australian Department of Health (35). As 80% of ACF residents experience persistent pain, it is highly likely that responding GPs would be involved in the care of patients with pain in ACFs and yet this resource was not used. The practicalities of guidelines generally was noted as a barrier to pain management and this was supported by another study of Australian GPs that found they would prefer succinct (2-3 pages) guidelines (505). Previous studies found that the Therapeutic Guidelines was also the resource most frequently used by Australian palliative care physicians, nurses and oncologists working with cancer patients with pain. However, these studies found lower guideline utilisation than our study of GPs [22% (oncologists); 45% (palliative care physicians); 71% (community nurses)] (486-488).

The median number of pain patients seen each week by the participants was 20, which based on an average of 90 consultations a week (477) accounts for 22% of patients seen by GPs. This is consistent with BEACH data, which found approximately 19-25% of GP encounters were

regarding persistent pain, 1.2% cancer-related pain and 5.2% persistent nerve pain (506, 507). Non-adherence to analgesics in patients who suffer from persistent pain is common with prevalence ranging from 8-62% (407) which is reflected in the perceptions of GPs. Previous studies have identified that analgesic underuse is more common than overuse in persistent pain (402, 407) and acute pain (406). In previous studies underuse in persistent pain has ranged from 2-53% with overuse ranging from 9-51%, with an average prevalence of 33% underuse and overuse (407). This was similar to what the GPs noted, although participants thought there was substantial overuse of as required opioids that is not in line with previous studies. As the previous adherence studies were not conducted in Australia it would be worth undertaking further investigations of patient adherence rates to the different types of analgesics in those with acute and persistent pain. Tasmanian regulations (508) require strict intervals between each dispensing of opioids, it is very concerning if this is the true rate of overuse of these opioids. Non-adherence is difficult to overcome, however often underuse is associated with misconceptions about analgesics, and overuse associated with increased pain intensity (407). Increased patient education and empowerment to better self-manage their pain may improve adherence rates.

It is acknowledged that these results may not be wholly generalisable to the Tasmanian or Australian GP community as there is potential for self-selection bias to occur. Nonetheless the results are consistent with previous studies in this area and are likely to be generally applicable to the Tasmanian and Australian population. Additionally, these results provide a solid basis for further targeted research into the future.

Identification of barriers is the first step required to overcome them (509). Pain management is complex for various reasons, including patient factors, medication factors, the complexity of the diagnosis and management of pain, and health system factors. Some of these barriers may be amenable to modification, however, others require substantial financial investment, policy changes and coordinated efforts across undergraduate and post graduate medical courses to improve the way pain is managed in general practice. In the shorter-medium term, education of allied health care professionals, GPs and patients is likely to be the most effective way at improving patient outcomes and reducing pressure on GPs. Improving the use of other members of the healthcare team, such as practice nurses and pharmacists may further assist in the management of persistent pain, and help support GPs to enhance patient outcomes. Particularly until a time where more services and funding are available to allow patients increased access to multidisciplinary teams managing pain.

Chapter 9: Identification of factors influencing Australian anaesthetists' perioperative management and perceived barriers to optimal postoperative pain management

9.1 Abstract

Background: Perioperative pain management can influence the incidence and severity of acute and persistent postoperative pain. This study aimed to identify what factors anaesthetists perceived as increasing the risk of postoperative pain; what factors influenced clinical practice; and potential ways to reduce the incidence of PPP.

Method: Private anaesthetic practices and public hospitals with a surgical unit were identified through an Internet search and contacted to ask that an electronic survey be distributed to all anaesthetists and anaesthetic registrars between November 2015 and January 2016.

Results: 175 surveys were completed. Three-quarters of respondents were consultants. Factors associated with PPP included: somatic persistent pain (87.3%); depression (80.1%); anxiety (79.5%); pain catastrophising (73.5%); visceral persistent pain (72.3%); and duration (70.5%) or severity (65.7%) of pre-operative pain. Clinical judgment (86.3%) and patient (85.7%) and operation factors (82.9%) were the most common factors influencing perioperative pain management. Potential ways to reduce the incidence of PPP included increased follow-up after discharge (49.1%), post-surgical neuropathic pain assessment (62.9%), pre-surgical screening of psychological factors (48.0%) and identification and production of a PPP risk assessment tool (62.3%).

Conclusion: Large-scale studies are needed to identify risk factors for PPP and develop a predictive model so that at-risk patients can be more readily identified. Additionally, randomised controlled studies are needed to evaluate the effect of pain specialist undertaking post-discharge follow-up on the incidence of PPP, as well as assessing the effect of psychological counselling aimed at reducing anxiety, pain catastrophising and increasing coping strategies on the incidence of PPP.

9.2 Introduction

In Australia there are approximately 2.4 million operations conducted each year (510), and at least 80% of patients experience acute pain following surgery with 20% experiencing severe pain (390, 511). Significant post-discharge pain has also been reported following surgery, with 30-54% of patients experiencing moderate-extreme levels of pain in the two weeks following discharge (415, 512, 513). Acute post-surgical pain can have short and long-term consequences, including increased risk of transition to PPP, which can occur in 5-85% of post-surgical patients

(82, 388), postoperative delirium, particularly in the elderly (514), increased risk of re-hospitalisation or extended duration of admission (392, 393, 515) and reduced capacity to participate in rehabilitation (393). Thus, it is essential to optimise the management of acute and post-discharge pain to reduce the incidence of these adverse events occurring.

A number of factors have previously been implicated in increasing the risk of acute post-surgical pain and PPP. Factors identified as increasing the risk of acute postoperative pain include type of surgery, surgeon experience, patient sex, age, genetics, pre-operative anxiety, pre-operative pain and pre-operative pain related disability (391, 439, 516-518). A number of these factors are the same or similar to that of PPP. The most common factors associated with PPP are high levels of acute pain, younger age, female, nerve damage during surgery, genetics, psychological factors such as anxiety, depression, and pain catastrophising, and pre-operative pain and duration (82, 141, 388). However, the evidence to support which factors influence the likelihood of post-surgical pain is poor, with a lack of standardised definition, studies often inadequately powered, variables not consistently recorded or reliance on patient recall (82, 388) making them difficult to apply to clinical practice. For these reasons, anaesthetists are likely to manage patients based on their previous experience in addition to clinical evidence.

A number of factors have been found to affect perioperative management of patients; most of these are comorbidities affecting the way in which patients are managed, including age and cognitive status (519); smoking status (520) comorbidities including diabetes (521, 522) cardiovascular disease (523, 524) or medications such as anticoagulants (525). However, the way pain is managed and what guides decisions regarding perioperative pain management is less clear. Guidelines regarding the management of perioperative pain provide general information about treatment options; however, they do not provide specific details about management or which of the large number of medications should be used preferentially or together (48, 526). Thus, there is the potential for substantial variability in the way perioperative pain is managed.

This study aimed to identify the factors that anaesthetists' associated with increased likelihood of pain following surgery, and how their management differed in these patients. Additionally, this study aimed to identify barriers and enablers to perioperative and post-discharge pain management to be able to identify ways to improve pain control and potentially reduce the incidence or severity of PPP.

9.3 Methods

An electronic survey was distributed to Australian anaesthetists and anaesthetic registrars. An extensive search of the Internet resulted in the contact details for private Australian anaesthetic practices and public hospitals undertaking surgery throughout Australia. For those organisations

where a publicly available email address was not available, the hospitals or private practices were contacted by phone to obtain an email address where the survey could be distributed through to all anaesthetists and anaesthetic registrars working at that facility.

The survey (Appendix 8) was conducted through Lime Survey (485). Participants were asked if they were registrars or consultants, if they worked in public or private practice (or both), for how many years they had worked in anaesthetics, and what type of procedures they most frequently attended. Based on previously identified pre-operative factors contributing to post-surgical pain (82), participants were asked which of these patient factors they considered increased the likelihood of acute and persistent postoperative pain, how their treatment would change if they identified patients as being at high risk of acute or persistent postoperative pain and what this was based on (for example, clinical guidelines, patient or operation factors or clinical judgment). Participants were also asked what measures would assist in reducing the incidence of PPP and barriers to acute and post-discharge pain. All variables were tick box, with the option of free text additional answers. Free text answers were classified into themes. The survey was open from November 2015 until January 2016. An incentive was used to enhance recruitment, which was the chance to win one of five $100 AUD gift cards. Ethics was approved by the Tasmanian Health and Medical Research Ethics Committee.

9.4 Results

Two-hundred and thirty participants commenced the survey, with 175 completing the survey. Only completed surveys were included in the analysis. The median number of years practicing in anaesthetics was 13 years (range 1-40 years). Of those who responded 132 were consultants and 43 (24.5%) were registrars. Registrars worked primarily in public hospital (95.3%), with the remainder working in both public and private sectors. Consultants most frequently worked in both public and private facilities (48.5%), followed by public hospitals only (43.0%) and a minority (8.3%) worked in private hospitals only. The median number of operations attended weekly was 20 (range: 4-40). Only 16 (12.8%) anaesthetists worked in one surgical specialty, with most working across more than one type of surgery. Anaesthetists attended procedures in general surgery (71.4%); day surgery (64.6%); and orthopaedics (63.4%) most frequently. Other specialties included obstetrics and gynaecology (48.0%); colorectal (44.0%); plastics and reconstruction (39.4%); head and neck (24.0%); paediatrics (25.7%); vascular (20.6%); interventional radiological procedures (17.7%); neurosurgery (16.0%); cardiothoracics (10.9%); other (9.1%); and 6.3% listed no specific surgical specialty.

Table 18 shows the factors that anaesthetists considered most likely to contribute to acute post-surgical pain or PPP. Other free text factors cited by anaesthetists as increasing the likelihood of acute pain were smoking status (3), obesity (2), younger age (2), infection (2), cancer (2) and its

treatment (3), lack of social support (2), compensation claim (2) and negative expectations of health carers (2). Three factors commonly cited by anaesthetists in both acute and persistent pain were perioperative factors (5, 4 respectively), pre-operative opioids (8, 5 respectively) and illicit substance abuse (5, 3 respectively). Five anaesthetists also noted severe acute postoperative pain was a predictor of PPP.

Table 18 Pre-surgical factors that anaesthetists considered were associated with the development of postoperative pain (n=166)

Variable	**Acute postoperative pain n (%)**	**PPP risk factors n (%)**
Depression	109 (65.7)	133 (80.1)
Anxiety	153 (92.2)	132 (79.5)
Pain catastrophising	138 (83.1)	122 (73.5)
Somatic persistent pain	141 (84.9)	145 (87.3)
Visceral persistent pain	106 (63.9)	120 (72.3)
Low socio-economic status	42 (25.3)	44 (26.5)
Low education level	40 (24.1)	45 (27.1)
Pre-operative pain severity	135 (81.3)	109 (65.7)
Duration of pre-operative pain	116 (69.9)	117 (70.5)
Re-operation on site	76 (45.8)	88 (53.0)

The most common influence on how the participants managed patients during the perioperative period was clinical judgment (86.3%), closely followed by patient factors (85.7%) and operation factors (82.9%). Hospital or department protocols (62.9%) or Australian (44.0%) or International (22.9%) guidelines were less frequently used to guide practice. Table 19 shows the different treatment modalities and how these would be used if patients were identified as being at high risk of experiencing acute post-surgical pain or PPP.

Table 19 How management changes if patients are identified as being at high risk of acute or persistent postoperative pain (n=161)

	Acute postoperative pain n (%)	**Persistent postoperative pain n (%)**
Regional Anaesthesia	129 (80.1)	116 (72.0)
Epidural	73 (45.3)	85 (52.8)
Perioperative local anaesthetic	106 (60.6)	93 (57.8)
Perioperative ketamine	118 (65.8)	127 (78.9)
Parecoxib	110 (68.3)	83 (51.6)
A short course of gabapentinoids	81 (50.3)	117 (72.7)
Patient controlled analgesia	123 (76.4)	88 (54.7)
Postoperative ketamine infusion	102 (63.3)	121 (75.2)
Postoperative local anaesthetic	49 (30.4)	63 (39.0)

Other free text suggestions that were made in relation to the management of pain if the patient was at high risk for acute pain were: multimodal analgesia (3), use of clonidine (3), patient

education (2), early intervention by the APS (1), loading dose of paracetamol (1), nursing education (1), neuraxial morphine (1), total intravenous anaesthesia (1), high dependency or intensive care admission (1). Other free text suggestions that were made in relation to the management of pain if the patient was at high risk for PPP were: multimodal analgesia (3), early involvement of a multidisciplinary pain team and/or APS (4), patient education (3), use of a TCA (1), clonidine (1) and total intravenous anaesthesia (1).

A number of potential initiatives were suggested to the anaesthetists and they were asked, which if any may assist with reducing the incidence of PPP. The most commonly selected options were: identification of and production of an assessment tool for predictors of PPP (62.3%) and post-surgical neuropathic pain assessment (62.9%). Nearly half of respondents (49.1%) thought increased follow-up after discharge and pre-surgical screening of pain catastrophising, anxiety and depression (48.0%) would assist in reducing the incidence of PPP. Other free text suggestions made by the anaesthetists included: Around the clock APS access (1), aggressive and/or improved acute pain management (2), appropriate post-discharge analgesics (1), early referral to chronic pain specialists (1), education about post-operation expectations and management strategies (6), pre-operative pregabalin (1), increased used of perioperative ketamine (1), routine NSAID (1), staff education regarding PPP (1), increased familiarity with regional anaesthetic techniques by ward staff and anaesthetists (1), postoperative physical therapy in patients with persistent pain (1) and ice-bucket immersion test in pre-operative clinic for moderate-major procedures (1).

Table 20 contains a list of the barriers to acute postoperative pain management and Table 21 contains a list of the barriers to post-discharge pain management. In acute pain management, analgesic adverse events and under-use were commonly cited as barriers to pain management. Free text responses from anaesthetists frequently cited staffing capacity (7.4%), knowledge of nurses (5.7%) and conflict between other specialties, or professions about pain management (7%) as other common barriers. One anaesthetist commented that a barrier to pain management was a “Belief that pain is not important (I know many surgeons who feel it is beneficial as "keeps BP [blood pressure] up")”. A lack of communication between the hospital and general practice, over and under use of analgesics and a lack of post-discharge resources were most commonly cited barriers to post-discharge pain.

Table 20 Barriers to optimal acute postoperative pain management (n=156)

Factor	**n (%)**
Postoperative analgesic over use	14 (9.0)
Postoperative analgesic under use	71 (45.5)
Adverse drug reactions	90 (57.7)
Education/knowledge	
Nurse	10 (6.4)
Patient	8 (5.1)
Generally	2 (1.3)
Anaesthetists	1 (0.6)
Patient factors	
Expectations	4 (2.6)
Comorbidities	3 (1.9)
English comprehension	1 (0.6)
Management factors	
Identification of pain/recognition it was a problem	7 (4.5)
Inappropriate prescribing/planning of discharge medications	6 (3.9)
Interference/conflicting goals between different specialities/professions	7 (4.5)
Staffing and resource capacity limiting treatment modalities and management	13 (8.3)
No dedicated APS	1 (0.6)
Delays in getting anaesthetic/pain management team to handle complicated patients	2 (1.3)
Early discharge preventing follow-up by pain team	1 (0.6)
Medication related	
Opioid phobia/underprescribing due to fear of overdose/diversion/addiction	3 (1.9)
Overuse of opioids	1 (0.6)
Medication safety	2 (1.3)
Outdated/non-existent protocols	1 (0.6)
Reluctance to use regional blockades or epidurals due to concerns from surgeons, patients, anaesthetist due to the risk of adverse events, evidence to support their use and time taken to use them.	2 (1.3)
Other	
Barriers to pain assessment pre-operatively	1 (0.6)
Reluctance to use minimally invasive surgical techniques	1 (0.6)

APS: Acute Pain Service

Table 21 Barriers to optimal post-discharge pain management (n=156)

Factor	n (%)
Post-discharge analgesic overuse	28 (17.9)
Post-discharge analgesic underuse	59 (35.5)
Post-discharge undertaking activities beyond recommended	45 (27.1)
Poor/slow communication between hospital and general practice.	107 (68.6)
Patient factors	
Patient education/knowledge/health literacy	10 (6.4)
Patient psychology and comorbidities	3 (1.9)
Patient expectations	1 (0.6)
During admission	
Inadequate discharge planning	2 (1.3)
Availability of medical personal at discharge with pain management knowledge	2 (1.3)
Not taking the patient into consideration with discharge prescribing	1 (0.6)
Medication related	
Opioidphobia	8 (5.1)
Safety	3 (1.9)
Mismanagement of pain by surgeon or GP	1 (0.6)
Post-discharge resources	
Inadequate discharge analgesia	3 (1.9)
Inadequate discharge information/poor communication with patients	3 (1.9)
Lack of patient resources	1 (0.6)
Patients understanding of how to take medications/wean	5 (3.2)
Lack of allied health services post-discharge	1 (0.6)
Lack of ongoing advice/prescription	1 (0.6)
Lack of follow-up with pain specialist	3 (1.9)

GP: general practitioner

9.5 Discussion

This is the first study that we are aware of that has reviewed the opinions of anaesthetists about the barriers to acute and post-discharge pain and what factors influence perioperative pain management. The anaesthetists suggested the most likely factors associated with acute postoperative pain were anxiety (92.2%), somatic persistent pain (84.9%), pain catastrophising (83.1%), pre-operative pain severity (81.3%) and its duration (69.9%). The pre-operative factors that anaesthetists thought were associated with PPP were somatic persistent pain (87.3%), depression (80.1%), anxiety (79.5%), pain catastrophising (73.5%), and visceral persistent pain (72.3%). Although these are consistent with previous studies (82, 202), based on these results it is clear that there is not a consensus among anaesthetists. Because perioperative pain management varied depending on perceived risk it is important to strengthen the evidence behind what factors put patients at increased risk of acute and persistent pain.

To date, the primary ways that studies have attempted to reduce the incidence of PPP are by trialling different peri- and postoperative pain management strategies to reduce the incidence of severe acute pain and prevent central sensitisation (203, 342, 527-532), using nerve sparing or minimally invasive surgical techniques (533), the development of predictive models for PPP (534, 535), although these are yet to be tested and require validation. Few other strategies have been trialled. Psychological factors have been found to influence many aspects of pain including the

likelihood of experiencing acute and persistent post-surgical pain (82, 536). However there has been no study that could be found that evaluated the impact of augmenting psychological factors, through, for example, CBT on the incidence of PPP. Nearly half (48.0%) of the participants in this study agreed that pre-surgical screening of pain catastrophising, anxiety and depression could potentially reduce the incidence of PPP. One study has incorporated psychological assessment and counselling to those at risk of or experience PPP, although this study has not evaluated the effect of this intervention on the incidence of PPP (537). This area requires substantial further research to identify if early identification and CBT influences the incidence and/or severity of PPP.

Numerous barriers to acute pain management were noted. These included analgesic under-use and adverse events, knowledge and education of patients and nurses about analgesics and staffing resources, reducing the capacity for certain modalities to be used. A number of anaesthetists also made free text comments regarding late or minimal involvement of anaesthetics or pain management specialists in care, low levels of nursing knowledge about pain, conflict between different priorities and different specialties, as well as limited knowledge of discharge doctors on the management of pain. These factors indicate that there is an increased need for APS (where available) or a dedicated anaesthetic or pain management staff member to review all post-surgical patients rather than just patients where pain is difficult to manage. Potentially, the involvement of the APS or a pain management team for every patient following surgery may improve both in-hospital acute pain as well as post-discharge pain through increased patient knowledge, clear patient expectations and the opportunity for the provision of suitable and sufficient discharge analgesics. It would also provide an opportunity for early identification of neuropathic pain symptoms associated with PPP, which anaesthetists commonly agreed (62.9%) would be beneficial in potentially reducing the incidence of PPP (538, 539).

Barriers to post-discharge pain include poor or slow communication between hospital and general practice and the lack of post-discharge resources, including analgesics and information as well as follow up potential. Few post-discharge resources coupled with low patient knowledge and health literacy indicates that this is an area that could be further targeted to improve post-discharge pain management. This could be undertaken through a number of methods including: increased patient written resources, a dedicated member of staff to see all patients at discharge to discuss their pain management, a dedicated pain-related contact number to call following discharge with queries and ensuring all patients, irrespective of their inpatient pain control are reviewed by a member of an APS or pain team. To further support patients manage their post-discharge pain, it is essential that hospitals make a clear decision about whose responsibility it is to provide pain management counselling on discharge. Putting a policy in place to ensure that all

patients are counselled about their post-discharge pain management by a suitably knowledgeable staff member, will likely improve post-discharge pain management and may reduce hospital costs through readmission due to pain as well as potentially reduce the transition from acute to persistent post-surgical pain.

In conclusion, these results demonstrate the need for more definitive studies to truly ascertain the risk of different patient factors on the development of acute and persistent pain, so that management can be tailored to those most likely to experience them. Furthermore, the development and validation of a pre-assessment tool to aid in the identification of those at high risk of PPP should be undertaken and utilised in pre-assessment screening in an attempt to reduce the incidence of PPP. The development of post-discharge resources to empower and sufficiently education patients to self-manage their pain is paramount for patient pain management, QOL and post-surgical rehabilitation. Randomised controlled trials assessing the effectiveness of increased pre- and post-discharge follow-up by pain specialists or the APS as well strategies aimed at reducing anxiety, pain catastrophising and improving coping mechanisms pre-operatively are needed in the hope that these strategies may reduce the incidence of severity of PPP in the future.

Chapter 10: The barriers to optimal pain management in Tasmanian aged care facilities: a qualitative study

10.1 Abstract

Background: Up to 80% of residents in ACFs experience pain; unfortunately, their pain is often sub-optimally managed. This study aimed to characterise pain management in ACFs, and identify the barriers to optimal pain management.

Methods: Semi-structured interviews were conducted with 23 staff (enrolled and registered nurses, and facility managers) at five southern Tasmanian ACFs from September to November 2015. Interviews included questions about how pain was measured or assessed, what happened if pain was identified, barriers to pain management and potential ways to overcome these barriers.

Results: There were no formal requirements regarding pain assessment at the ACFs reviewed; however, pain was frequently informally assessed. Nursing staff noted the importance of adequate pain management for the residents' quality of life and employed both non-pharmacological and pharmacological techniques to reduce pain, when identified. The barriers to optimal pain management included: difficulty identifying and assessing pain, residents' resistance to reporting pain and/or taking medications and communication barriers between the nursing staff and GPs.

Conclusion: Nursing staff interviewed were dedicated to managing residents' pain effectively, however a number of areas could improve resident outcomes. These include a more consistent approach to documenting pain in residents' progress notes and improving nurse-GP communications to ensure that new or escalating pain is identified and expedient changes can be made to the resident's management. Additionally, resident, family, nurse and carer education, conducted within the facilities on a regular basis, would assist in improving the pain management of residents.

10.2 Introduction

Up to 80% of residents of ACFs experience pain (444). Pain management in the elderly is complicated by minimal trial evidence supporting medication efficacy and safety (228, 540). ACF residents have a high number of comorbidities and co-prescribed therapies (108, 228), which increase the risk of adverse events and drug or disease interactions. Additionally, in this population dementia, dysphagia and hearing impairment are common comorbidities, which further complicate the ability for patients to adequately communicate their pain (219, 541, 542).

Assessment of pain in patients without cognitive impairment has often relied on self-reporting. However, older patients have been previously identified as being reluctant to take analgesics for numerous reasons including not wanting to be a nuisance or wanting to be a good patient, fear of addiction, fear that pain is a sign of something sinister and a patient belief that pain is a normal part of ageing (404, 437, 541, 543-545). These factors reduce the likelihood of patients reporting pain (546). For those patients with cognitive impairment, the assessment tools for identifying pain are poor, with limited evidence to support their reliability and effectiveness at identifying pain (547). Additionally, behavioural problems in dementia, caused by unrelieved pain, are sometimes being mismanaged with the use of antipsychotics rather than pain relief medication (540, 548). All of these factors make the management of pain in this population group challenging.

Pain is often undermanaged in elderly patients in in ACFs (12, 13). A number of international studies have evaluated the knowledge and attitudes of those working with ACF residents regarding pain (549-551). Numerous factors have been identified as detrimentally affecting pain management in ACF including workloads, difficulty identifying pain, knowledge deficits, nursing and physician attitudes and misconceptions, patient barriers, patient stoicism, patient communication and GP-ACF communication (219, 541, 542, 549-553). However, minimal research has been undertaken in Australia identifying barriers to optimal pain management in Australian ACFs. This research aimed to characterise pain management in ACFs in southern Tasmania, and identify the barriers to optimal pain management.

10.3 Methods

All southern Tasmanian (Australia) ACFs, with both dementia specific and non-dementia specific beds, were contacted via mail regarding participation in the study, with follow-up phone calls to the facility managers. Of the 16 ACFs contacted, five agreed to participate within the research timeframe. These ACFs had a median of 99 beds (85-171), mainly consisting of high dependency (nursing homes) beds. Participating ACFs were asked to provide the details of five or six staff members (enrolled or registered nurses) who would be willing to undertake 15-20 minute semi-structured interviews to discuss pain management at the facility. The facility manager at each ACF was also interviewed. As carers (lifestyle workers) are unable to provide analgesics to residents, they were not interviewed for this study. Semi-structured interviews (Table 22) were conducted with 23 staff at the participating ACFs from September to November 2015.

Table 22 Semi-structured questions for interviews

Number of years working in aged care facilities
Working primarily with (ie. Dementia patients, non-dementia patients, both)
How important is adequate pain management for residents to you?
For residents receiving analgesics, how often each shift would you ask the resident what their pain was like or ask them to rate their pain?
What do you do with this information?
For residents prescribed as required analgesics, what are the most common reasons that would result in you providing them analgesics?
For residents who are unable to communicate, how do you identify if they are in pain?
What do you think is the major barrier(s) to pain management in residents of aged care facilities who do not have dementia?
What do you think is the major barrier(s) to pain management in residents of aged care facilities who do have dementia?
How do you think the barriers to pain management in ACFs could be overcome?
Have you done any formal or informal training regarding pain management in aged cared facility residents?
How would you describe the level of knowledge you have about pain management in elderly patients?
Do you think it would be useful to have further training in pain management of elderly patients?

Following data collection and subsequent verbatim transcribing, the data were segmented into themes through the process of coding. Deductive coding was initially undertaken using pre-determined categories, based on previously published barriers and enablers to pain management, developed prior to the data collection. Following initial coding, the data was then categorised using inductive coding to ensure all themes and sub-themes were identified. Both inductive and deductive coding was completed by one researcher.

The interviews were analysed using QSR NVivo Version 10 (NVivo qualitative data analysis Software; QSR International Pty Ltd. Version 10, 2014). The results were tallied to identify the most commonly cited themes and sub-themes. Each interviewee received a $20 AUD gift card to compensate them for their time. Ethics was approved by the Tasmanian Social Science Human Research Ethics Committee.

10.4 Results

Twenty-three interviews were undertaken with enrolled nurses (EN) (n=7), registered nurses (RN) (n=11) and facility managers (n=5). The median number of years that individuals had been working in aged care was 20 (range 2-43). All participants suggested that pain and its management was paramount to residents' quality of life. For example, one interviewee said:

> *"If you're in pain, you have poor quality of life. It ruins everything for you".* (Interviewee 11)

Participants frequently noted that mismanagement of pain was time-intensive, with one commenting:

> *"Well if you've got a resident that has their pain completely unmanaged and they're crying out in pain – that's going to take up an incredible amount of resources and staff time. So if we've got someone that is unmanaged – I've seen it happen before – it takes an incredible amount of time to bring that pain under control. So you're using a lot of resources to try and then bring them back to a level where they're comfortable."* (Interviewee 16)

Staff also commented that good pain management reduced behavioural issues, made the work environment more pleasant and improved staff motivation and job satisfaction:

> *"I actually feel as though I'm doing my job properly if I know that somebody hasn't got pain".* (Interviewee 2)

Most ENs and RNs believed that they had adequate or good knowledge about pain and its management; however, most suggested more training would be useful. Four out of five facility managers also agreed that more pain management training would be beneficial to staff. Topics that participants wanted more training on included: identification and assessment of pain, medication management, non-pharmacological management, and information on pain-causing conditions. Two participants specifically mentioned the University of Tasmania's Massive Open Online Course (MOOC) on dementia care (554) as a good educational tool.

There were no specific guidelines or policies regarding the frequency of asking about pain or recording pain intensity at any of the ACFs; despite this, pain was still informally assessed frequently by staff during shifts. Generally, ACF staff assessed pain primarily using the Abbey pain scale or the to a lesser extent the face scale chart for those with cognitive decline or dementia. Pain was more commonly assessed through question asking and observation for those without cognitive impairment. Some participants also mentioned by that it was important to rephrase questions and use different language when asking about the resident's experience of pain. One participant said:

> *"That's the other thing too - not to use the word pain because a lot of people don't understand or perceive the word pain is the right word for them. So if I say to someone 'have you got pain' when I know that non-verbally they look uncomfortable, and then I'll scale it down to something else like 'are you uncomfortable?' You've got to find the right word that suits them".* (Interviewee 6)

The importance of knowing the residents well so that any change in behaviour could be more readily identified and managed was frequently noted. For example, one interviewee noted:

> *"I think that the one barrier could be if you don't know them that well. A lot relies upon what you see, because they can't tell you. So new staff can be a bit of a barrier."* (Interviewee 3)

In addition, it was frequently noted that carers often identify and report pain to the RNs, one interviewee said:

> *And of course the carers get involved in that a lot too, because they're with the resident. So I expect them to be able to recognise pain and they're often the ones that will come to the nurses first or come and say 'look – I think they've got pain', or 'this is happening with them and this is different to what they normally are'. And so nurses have to learn to respect the carers and trust their judgments sometimes too." (Interviewee 22)*

A numerical rating scale was also frequently used; however, 12 participants commented on the lack of effectiveness of pain scales. One respondent said:

> *"… I know that's the tool to be used, and it's the tool that we use during those periods of assessment, but in a general day to day I think it's more a case of using familiar type language to get that response".* (Interviewee 23)

If pain was identified by nursing staff, generally they would administer 'as required' analgesics (if charted) and monitor for effect, liaise with the GP to change analgesic prescriptions, utilise non-pharmacological management strategies and record the presence of pain in the computerised record system. In relation to what they do if someone is in pain, one interviewee said:

> "*Yeah, so massage, heat packs, repositioning, resting – it depends upon where they are, what they're doing at the time of that pain and what their needs are at that time. And we'll work that out and provide a lot of other remedies rather than just the analgesic because that's not just the sole purpose of it".* (Interviewee 17)

Table 22 summarises the main barriers to optimal pain management in ACFs. In residents with dementia, these barriers were identification of pain, residents' resistance to taking medications and dementia-related behaviour disguising the diagnosis of pain. The major barriers identified in the management of pain in residents without dementia were the influence of families over the

management of pain, resident stoicism and residents' reluctance to report pain. One interviewee said:

> "*Some people deal with their pain a bit differently. But you can usually tell, but you do have to prompt some residents to say – yes my shoulder is hurting. They can sit there and not want to complain*". (Interviewee 8)

Other barriers included fear of giving too much pain relief, for example:

> *"I think that sometimes there's still a little bit of mythology about opioids and 'oh you know I didn't want them to die on my shift so I didn't give them the morphine'".* (Interviewee 18)

A lack of staffing resources was also noted, with one interviewee commenting:

> *"For an RN, they love doing pain management they would love to do it their entire shift no problem, but there are a whole lot of other things that are taking priority – somebody falls on the floor, all the emergencies that they're dealing with means it's always going to be put back. It's always at the end of the list".* (Interviewee 10)

There was also concern regarding nurse-GP communication. For example, one interviewee said:

> *"To be honest, we don't always have GPs that understand or are willing to look at pain management and utilise perhaps the available resources that we have for that".* (Interviewee 23)

Another commented:

> "*And they (young nurses) do really good clinical handover and if the GPs actually stepped back and looked at what was being communicated to them by these grad nurses its actually high quality stuff".* (Interviewee 11)

Additionally, one interviewee also noted that sometimes it was necessary to request second opinions regarding pain management; they said:

> *"There were a couple of conversations last week around a particular GP … that was very stingy in terms of pain relief that he was providing for a resident that was end stage care. And in the end we had to go above his head and ask palliative care to come in and become involved and get what we wanted. We don't like to do that, but we're here for the resident. Residents' care, comfort and safety is paramount for us, and we*

don't believe in egos or any of that crap, so if we need to step on people's toes to make the resident comfortable then we will. And we did". (Interviewee 16)

Table 24 summarises the suggested methods to overcome barriers to optimal pain management in ACFs, including improved nurse-GP communication:

"*Maybe if the organisation as a whole developing better relationships with our doctors*". (Interviewee 2)

Another suggestion to improve pain management was improved assessment and documentation:

"*One of the needs that I think we could improve upon is the assessment side of it. Not just the visual assessment, the monitoring the reporting and the documenting of the residents' pain in a professional way*". (Interviewee 23)

Further staff education was also cited by some, as well as resident education:

"*They [residents] will listen once you explain and give them medication and say 'you are not going to get addicted to having 8 Panamax [paracetamol 500mg] a day'. The majority will listen and say 'oh I didn't realise that*". (Interviewee 14)

Table 23 Barriers to the management of pain in aged care facilities (n=23)

Theme	n (%)
Resident related barriers – non-dementia	
Resident related barriers to optimal pain management	18 (78.3)
Stoicism	13 (56.5)
Honesty of reporting pain	11 (47.8)
Families' influence over medication	11 (47.8)
Resistance to taking medications	10 (43.5)
Not wanting to be a bother	4 (17.4)
Communication barriers (deafness)	1 (4.4)
Stigma regarding pain	1 (4.4)
Lack of trust in staff	1 (4.4)
Medication related barriers to optimal pain management	
Fear of side effects	5 (21.7)
Dislike of taking tablets	3 (13.0)
Fear of addiction	2 (8.7)
Concern about medication cost	1 (4.4)
Resident related barriers – dementia patients	
Dementia resident related barriers to optimal pain management	22 (95.7)
Identification of pain	19 (82.6)
Resistance to taking medication	9 (39.1)
Dementia related behaviour can disguise pain	8 (34.8)
Patients are unable to accurately report pain	6 (26.1)
Effect of families on the management	3 (13.0)
Difficulties assessing effectiveness of pain management strategies	2 (8.7)
Difficulty in administering medications	2 (8.7)
Doctor related barriers	
Doctor related barriers to optimal pain management	12 (52.2)
Reluctance to medicate	5 (21.7)
Disregard nursing staff opinion	5 (21.7)
Lack of doctor engagement	3 (13.0)
Lack of knowledge	1 (4.4)
Unwilling to try new medication	1 (4.4)
Slow to respond	1 (4.4)
Facility related barriers	
Facility related barriers – non dementia	12 (52.2)
Efficacy/usefulness of pain scales	8 (34.8)
Staff reluctance to use strong pain relief	2 (8.7)
Resourcing and prioritisation of time	2 (8.7)
Lack of understanding of pain and triggering conditions	1 (4.4)
Facility related barriers – dementia patients	
New staff not being able to identify pain in patients	4 (17.4)
Time involved in the identification and management of pain in those who cannot articulate pain	4 (17.4)
Facility related barriers – generally	
Nurse fear of providing too much analgesia	4 (17.4)
Staff uncomfortable contacting prescribers to change medication orders	4 (17.4)
Challenges identify pain in residents	4 (17.4)
Red tape around the provision of pharmacological and non-pharmacological management strategies	2 (8.7)
Poor/unstructured communication with doctors	2 (8.7)
Lack of continuity of care with part-time staff	1 (4.4)
Delegation of pain management to specialists staff	1 (4.4)
Lack of integration of pain assessment outcomes into general knowledge	1 (4.4)
Pre-conceived ideas around residents assessment of pain	1 (4.4)

Table 24 Ways that barriers to optimal pain could be overcome in aged care facilities (n=23)

Theme	N (%)
Staffing factors	
Pain management training for staff	5 (21.7)
Being observant – watching for non-verbal signs of pain	4 (17.4)
Greater staffing resources	3 (13.0)
Empowering staff to advocate on the patient's behalf	1 (4.4)
Person centred care	1 (4.4)
Rostering of staff to ensure continuity of care	2 (8.7)
Involving new staff members in pain assessment for alternative opinions/perspectives	1 (4.3)
Doctors-ACF interactions	
Guiding doctors' to make decisions regarding pain management	3 (13.0)
When GPs are reluctant to change pain therapy the ACF obtain a second onion e.g. from palliative care services	3 (13.0)
When communicating with doctors ensuring nursing staff have sufficient and ordered information to present to the GP	2 (8.7)
Use senior staff to communicate with doctors	2 (8.7)
Improving relationships between staff and doctors	1 (4.3)
Patient and family factors	
Utilising collaborative treatment approaches with family consultations	6 (26.1)
Improved communication with families about pain management	5 (21.7)
Refer patient/family to GP if ACF cannot convince GP to change analgesic order	4 (17.4)
Education of residents	4 (17.4)
Education of families	3 (13.0)
Using different language when describing/questioning residents about pain	3 (13.0)
Providing reassurance and encouragement to overcome resistance to treatment	2 (8.7)
Supporting families to changes GPs if the family is concerned about their loved one's management	1 (4.3)
Patients' reluctance to use analgesia	
Hiding analgesia in food	5 (21.7)
Gaining the residents trust	4 (17.4)
Referring patients/families to GP if patient is non-compliant	4 (17.4)
Using alternative dosage forms	4 (17.4)
Trial and error to find a successful management strategy	4 (17.4)
Persisting when patients refuse analgesia	3 (13.0)
Offering non-pharmacological treatment strategies when analgesic are resisted	2 (8.7)

GP: general practitioner; ACF: aged care facility

10.5 Discussion

This is the first qualitative study we are aware of identifying barriers to optimal pain management in Australian ACFs. The staff interviewed were all very cognisant that pain and its management was important to residents. Pain was frequently assessed through both formal and informal methods, although none of the ACFs required pain to be assessed a certain number of times per shift. When pain was identified by staff, the management strategies employed were dependent on the resident and their circumstances. A number of barriers to optimal pain management were identified; these included resident factors such as a reluctance to report pain or take analgesics, factors related to the identification and assessment of pain, particularly in those with dementia, and communication barriers with GPs.

It was concerning that only 70% of participants said that the presence of pain was recorded in the facility's computer system, which is what staff generally refer to when reviewing patient progress and health. A previous study evaluating pain management in ACFs found documentation of pain assessments in a one-month period was 85%; however, it was only 32% during a week and this documentation often lacked details regarding location, severity, characteristics or QOL (555). This is an area that could be improved upon, and would also allow for improved documentation to be provided to the GPs when making decisions regarding a resident's pain management.

Most participants (over 60%) indicated that they would contact prescribers to change analgesic orders if escalation of pain management was required. However, communication with doctors was noted as a barrier to pain management, in terms of both the confidence of the nurses to speak to the doctors as well as the doctors' reluctance to change therapies, or having sufficient documentation to justify a change to medication orders to the doctor. Nurse-prescriber communication has previously been identified as a barrier to patient safety and outcomes (553). Potentially, some of these barriers could be overcome by putting in place more definitive procedures and increased documentation in the resident care software. Additionally, changing the way in which interactions with GPs occur may reduce some of the barriers. One approach could be for all interactions to occur with the senior nursing staff only to improve communication, reduce fear of communicating with GPs, improve the lines of communication between the ACF and the GP, and improve the speed with which analgesic orders and changes are made. While every effort should be made to optimise communication with the GP, other avenues to improving pain relief for residents, particularly those in a palliative situation should also be considered, including timely referral to a palliative care service if needed.

Increased knowledge and education around pain management in ACFs can improve the knowledge and beliefs of nurses (550, 551, 556, 557). Often these programs involved education sessions over multiple weeks or months with nursing staff only (551, 556, 557) or integrated with both nursing staff and residents (558), with a comparison of nursing knowledge and beliefs before and after. However, it is unclear whether the improved knowledge and attitudes persisted and whether increased knowledge did in fact result in behaviour change in the medium-long term. Thus, the best way for these types of education interventions to be implemented and the true effect of them in the short and longer term on the management of pain in ACF needs to be further assessed.

Participants in this study felt unable to consistently and accurately identify pain in residents with dementia and exhibited concerns regarding providing too much analgesia. Education, which was

wanted by the vast majority of ENs and RNs, could provide some assistance in the identification and improved management of pain. However, as noted previously, the tools available for assessment of pain in residents with dementia have poor evidence to support their use (547). The advent of a new phone application, Electronic Pain Assessment Tool (559), designed to assist with the identification of pain in people with dementia has the potential to provide significant benefits to the speed of identification and management of pain in these residents. As staffing resources and time were noted as barriers to pain management, this could reduce some time pressures through faster identification of pain. Watching for signs of resident discomfort or changes in behaviour should also be encouraged by all staff, which could be facilitated by further staff education.

If educational activities were to be undertaken, a previous Australian study (560) found that these would need to be easily accessible, affordable and would require the employer's support. Consequently, online resources, or in-facility education sessions would appear to be the most suitable options. Education should also be undertaken with carers, as they spend substantial amounts of time with the residents undertaking a number of activities of daily living. Improving carers' knowledge of signs of pain might improve reporting and management of pain.

Based on the responses from staff, residents provide a significant barrier to their own pain management which is consistent with previous literature(404, 437, 541, 543-545). It is important that some of these barriers are overcome. One approach could be joint or individual resident and family education sessions around pain and its management, which a number of staff did comment was an effective way to overcome barriers around pain management. The inclusion of family members is also important as some studies, although not necessarily undertaken in ACFs, have indicated that the expectations of family members can influence the assessment of pain (219) and having a supportive family has been found to reduce analgesic consumption and pain intensity, and improve physical function (561). Additionally, education programs incorporating family caregivers of cancer patients living in the community found that they improved patient and carer knowledge and attitudes, as well as patient QOL (558). However, there is a dearth of literature surrounding the education of family members and the effect that this has on pain management of residents in ACFs. Further studies are needed in this area.

In conclusion, a number of barriers to optimal pain management were identified, including resident, prescriber and facility related factors. A significant number of the barriers could be at least partially overcome through increased education of residents, families, RNs, ENs and carers. Routine documentation of suspected or actual pain in the resident's medical notes is likely to improve continuity of care and monitoring of new or escalating pain, particularly noting the part-

time workforce in ACFs was cited as a barrier to pain management. Barriers associated with the management of pain between GPs and ACFs are more difficult to overcome. However, increased documentation of pain in medical notes and the use of only senior staff to contact prescribers about the requirements to change or escalate analgesics may provide better communication between GPs and the ACFs and allow for more expedient changes to pain management.

Chapter 11: Concluding discussion

11.1 Thesis background and research objectives

Nearly all people experience acute pain in their lifetime and while persistent pain, defined as pain lasting greater than three months, is less common, it is nonetheless experienced by 20% of the general population, 50% of elderly patients living in the community and 80% of those in ACFs (5-17). Prevalence rates appear consistent from studies undertaken in different continents, indicating that persistent pain is a significant global problem. It is also very costly (53, 56), with patients who suffer from persistent pain conditions more likely to present to a GP (58) and have increased absenteeism from work (161).

The evidence base for acute management generally supports the use of analgesics (48), although are variable; however, there is poor evidence to support the use of analgesics in persistent pain management (89, 231). Elderly and frail patients are disproportionally affected by persistent pain, but unfortunately, they are often underrepresented in, or excluded from clinical trials (228, 231). This further complicates decision making, as the lack of information is a barrier to reliable assessment of the balance between adverse effects and effectiveness. Elderly patients experience altered pharmacokinetics and pharmacodynamics, take multiple medications and often have multiple comorbidities, all of which expose them to an increased risk of adverse events and altered responses to the medications (101, 227, 228). Older patients are also less likely to report pain and take analgesics (404, 437, 541, 543-545) and those with neurodegenerative diseases such as dementia or following a stroke may be unable to adequately communicate their pain, and therefore assessment by nursing stuff is required to identify pain. Consequently, there have been many studies demonstrating that pain is undermanaged in the elderly (449, 452, 456, 457).

Pain and its management has been highlighted as an area of health requiring more research. One of the goals of the National Pain Strategy [Australia] (35, 36) is to increase the amount of research being conducted in areas such as assessing attitudes towards pain and its management, and reviewing the safety and efficacy of pain management in Australia. Further to this, The Opioid Policy developed by The Royal Australasian College of Physicians (38) suggested further areas for research should include: identification of risk factors for the development of persistent pain conditions; improving the management of persistent pain; and reducing the harms around persistent pain management, specifically opioids.

Because there are so many different aetiologies that cause pain, this thesis reviewed pain management in the elderly, more broadly, as well as focusing on one specific type of pain, post-surgical pain (from acute to PPP). Reviewing the transition from acute postoperative pain to PPP was also recommended at the 14th World Pain Congress (386) and in the National Opioid Policy

(92) to aid in identifying predictors of PPP. There are 2.4 million operations conducted each year in Australia, and at least 80% of those patients will experience acute pain. Around 20% of all patients will transition from acute postoperative pain to PPP; however, the range varies between 5% and 85% depending on the surgical procedure (82, 202). PPP contributes significantly to the overall population who have persistent pain; for example, surgery was identified as a potential cause of pain in 20% of patients attending British pain clinics (417). Due to an increasing number of health problems in older people, they frequently require operations. The most common age group requiring surgery are those aged 55-64 (562). As this population continues to age, it is important that the factors associated with PPP in older Australians are assessed and ways to improve outcomes determined.

In conclusion, this thesis aimed to add to the literature regarding pain management in Australia and identify predictors of persistent pain through a number of complementary studies. The specific research objectives were to:

- Observe how pain is managed pharmacologically by patients, nurses, surgeons, GPs and anaesthetists;
- Identify what factors are associated with the development of PPP;
- Identify QUM issues related to the management of pain; and
- Identify the barriers and enablers to pain management.

11.2 Research objective outcomes

11.2.1 Objective 1: Observe how pain is pharmacologically managed by patients, GPs, nurses, surgeons and anaesthetists

A number of Chapters (Three to Six) reviewed how patients took their analgesics to manage their pain. The management of pain by patients was often (although not universally) characterised by underutilisation, with a reluctance to take analgesics, a stoicism to try and endure with the pain and a fear of over using analgesics, being cited as common justifications for underuse. However, some patients were also noted to overuse their analgesics, including 6% of patients in Chapter Three using more than the recommended dose of paracetamol, putting them at risk of liver failure. These findings add to the existing literature about how patients, particularly elderly patients, take their medications. Previous studies have demonstrated similar results, particularly in relation to patient factors (404, 437, 541, 543-545); however, the studies included as part of this thesis add to the body of country-specific literature about how older Australian patients manage their pain with analgesics. These results also demonstrate that despite previous studies indicating patient reluctance to report and manage pain, substantial headway has not been made

into improving patient expectation, knowledge and capacity to self-manage pain, particularly in older Australians.

Chapters Six, Seven, Eight and Ten reviewed aspects of how GPs manage pain. The prescribing of analgesic by GPs was, at times, not in accordance with guidelines, particularly in relation to the use of opioids and the use of optimised paracetamol. A number of harm minimisation strategies were also infrequently used. These included less than one quarter of GPs regularly reviewing the 5As (analgesia, activity, adverse events, aberrant behaviour and affect) in patients with persistent pain despite analgesics, particularly opioids, often causing substantial adverse effects and having variable effectiveness.

Inappropriate and unsafe medication combinations were frequently prescribed to those patients reviewed in Chapters Six and Seven. Noting the risks of these combinations in this elderly population these results are concerning. The concurrent prescribing of benzodiazepines and opioids has been frequently noted in the developed world (563). This practice continues despite safety concerns and guidance recommending benzodiazepines should not be used for more than two to four weeks (220). Similarly, the use of opioids at doses exceeding the recommended maximum was also relatively common. However, to some extent, several factors conspire to force GPs into using opioids and increasing their doses in an attempt to help their patient. These factors include poor access to pain clinics and limited funding of allied health services, both of which have potential to improve physical function. However, there was still low concordance with guidelines in relation to non-opioid analgesics and inappropriate co-prescribing, increasing the risk of adverse events including confusion, falls and fractures in the elderly, as well as limited use of harm minimisation strategies, which are largely under the direct control of GPs. There is a need for an increased emphasis on pain and its management during undergraduate and GP specialist training as well as ongoing CPD. Such education should aim to try and improve concordance with guidelines and reduce the incidence of inappropriate prescribing, particularly in relation to opioids.

The way in which perioperative and postoperative pain was managed by anaesthetists was reviewed in Chapters Four, Five and Nine. There was significant variation in the way anaesthetist's managed pain, particularly for those patients undergoing orthopaedic surgery, as described in Chapter Five. Based on anaesthetists' responses in Chapter Nine, the management appears to be strongly reliant on clinical judgment, patient factors and operation factors, rather than guidelines and protocols. It was noted that the management strategies employed by the anaesthetists varied depending on the perceived risk of acute and persistent postoperative pain. There was also a lack of consistency regarding which factors were perceived to increase the risk

of PPP, which is likely reflective of variability in studies published to date (82, 202). However the management strategies employed by the anaesthetists for those patients perceived to be at risk of PPP were different to those who were at increased risk for acute postoperative pain. Because perceived risk and clinical judgment affected the perioperative management of pain, the need for accurate and complete information in relation to the predictors of PPP is needed. Further large-scale studies, using similar research protocols and definitions, should be undertaken in this area to help anaesthetists target at risk patients more accurately.

The way in which surgeons managed pain was reviewed through the discharge medications prescribed to patients in Chapters Three, and to a lesser extent Chapters Four and Five. There was substantial variation in the way in which discharge prescribing of analgesics was managed, with only just over 50% of surgical patients receiving discharge analgesia in Chapter Three, despite 95.3% of participants requiring analgesics in the week following discharge. Chapter Three in particular demonstrated that there is a need to improve the consistency of discharge prescribing to ensure that all patients have sufficient, but not excessive access to analgesics following discharge to adequately manage their pain. This is an area that requires further investigation to identify what, if any, protocols exist to dictate whether patients receive discharge analgesics and what type they receive in order to optimise the management of post-discharge pain.

In Australia, there has been very little research into the management of pain in ACFs and we sought to fill this gap in the literature. Our study (Chapter Ten) generally found that ACF staff reviewed pain informally through observation (69.6%) and for patients with cognitive impairment the Abbey Scale (47.8%) or a face scale (13%) were used most frequently. If patients were identified as having pain, nursing staff would provide an "as required" analgesic (if charted) (56.5%), liaise with a GP to change the analgesic order (60.9%), utilise non-pharmacological management strategies (56.5%), and record the presence of pain in the patient's medical notes on their computer system (69.6%). Overall, a number of barriers to pain management in ACFs were identified, including patient stoicism and reluctance to take analgesics, challenges with identifying pain in patients with cognitive impairment, and conflicting opinions between the ACF staff and GPs relating to how pain should be managed in some patients. The results of this study were consistent with previous barriers to optimal pain management reported in international studies (219, 541, 542, 549-552, 564-568), particularly in relation to patient stoicism and reluctance to take analgesics. This study significantly contributes to the current body of literature, as no other published studies could be identified that reviewed nursing-related barriers to pain management in Australian ACFs.

11.2.2 Objective 2: Identify what factors are associated with the development of PPP

Surgery in older patients is becoming increasingly commonplace, including those very elderly patients (over the age of 80). It is important that the factors associated with the development of PPP in this older population is specifically assessed as numerous factors including differences in pain experience and perception, patient factors including stoicism and the way in which pharmacological agents work in this population are different to that of a younger adult cohort. Numerous factors have been previously identified as increasing the risk of PPP; these include psychological factors such as anxiety, pain catastrophising, pre-existing persistent pain conditions, and uncontrolled acute pain (82, 202, 203) however with the changing demographics of who is undergoing operations these factors need to be continually assessed to ensure that they are consistent across age groups. Chapters Four and Five incorporated all major previously identified patient factors and intraoperative factors (where consistently available). The studies conducted as part of this research also focused on the post-discharge period, up to three months postoperatively. This is a period that has not previously been the subject of much research; however, the few studies in this area have indicated that uncontrolled pain following hospital discharge is associated with pain persisting (206-208).

The factors that increased the risk of pain at 12 months following a sternotomy included younger age, pre-operative anxiety, pre-existing musculoskeletal pain, number of pre-existing pain sites, self-rated poor health, a DN4 ≥3 at three months and 12 months. The factors that increased the risk of pain at 12 months following orthopaedic surgery included increased number of pre-existing pain sites, pre-existing alcohol use, moderate-severe pain at 10 days and six weeks and a DN4 ≥3 at three months and 12 months. The findings from these studies support the existing literature, with previous pain conditions and anxiety being identified as factors increasing the risk of PPP. This study, however, adds substantial weight to the association between uncontrolled post-discharge pain and PPP, as well as neuropathic pain (DN4 ≥3) during the subacute period, following discharge and PPP. Although younger age was associated with PPP, two risk factors, pre-existing pain and a reluctance to take analgesics (resulting in potentially uncontrolled post-discharge pain), are associated with PPP and common in older people. Consequently, it is important older patients are encouraged to manage their pain carefully and use analgesics as required following discharge to prevent uncontrolled pain. The results from Chapters Three, Four and Five also clearly show that undermanagement of pain following hospital discharge is an issue. This is noteworthy, considering that uncontrolled post-discharge pain and neuropathic pain symptoms were associated with pain at 12 months. An increased emphasis on the importance of post-discharge pain management and increased pain specific follow-up is required to improve the management and potentially reduce the incidence and/or severity of PPP.

11.2.3 Objective 3: Identify QUM issues related to the management of pain

QUM issues related to the management of pain were identified in a number of chapters. The first key issue was the lack of concordance between practice and the available guidelines and recommendations regarding pain management, particularly in relation to the use of opioids. The use of dangerous combinations of sedating agents, particularly benzodiazepines and opioids was common place and has significant potential to harm patients and potentially result in their death through respiratory depression or obliquely through increased fracture risk. The second key issue was the patient's ability to safely and adequately self-manage their pain following surgery. Self-management of pain by patients was generally (although not always) characterised by the underutilisation of analgesics (resulting in under management of pain), often due to misconceptions about analgesics, how they work and their associated risk profile. There is a need to improve patient knowledge and capacity to self-manage pain adequately in order to improve patient outcomes. The third issue was the variability in counselling provided during the inpatient stay or at the point of discharge, regarding post-surgical pain management. This was found to vary in terms of which health care professionals were involved and the content of information provided. Additionally, the actual supply of take-home analgesics following surgical procedures was often inadequate, with only 70% of patients receiving analgesics on discharge, despite 95.4% of patients reporting use of analgesics in their first week following surgery.

11.2.4 Objective 4: Identify the barriers and enablers to pain management

Barriers and enablers to pain management were mostly discussed in Chapters Eight, Nine and Ten, although some barriers, particularly patient-related barriers, were also identified in Chapter Three, Four and Five. In Chapter 8 GPs identified a number of barriers to optimal pain management including Healthcare system factors such as long waiting times for and access to pain clinics, limited government funding of allied health professions (psychologists and physiotherapists) and surgical waiting times. Other barriers to pain management included patient factors such as unrealistic expectations, and a reluctance to use non-pharmacological or self-management strategies. The risks and current lack of good quality evidence were also noted as barriers to optimal pain management. Particularly noting that the evidence regarding analgesic use in the elderly and/or frail is even more uncertain than general adult guidelines, coupled with a patients' reluctance to use non-pharmacological management strategies, it creates a very difficult position for the GP to be in and to manage.

In Chapter 9, anaesthetists identified a number of barriers to optimal acute pain management including under and overusing medications, staffing resources, conflicting priorities and minimal involvement of pain specialists. They also noted that communication was often poor or slow

communication between hospital and general practice and this coupled with a lack of post-discharge resources were reasons they believed worsened post-discharge pain outcomes. A number of barriers to the pharmacological management of pain and assessment of pain were identified in ACF in chapter 10. These included resident factors such as reluctance to report pain or take analgesics and stoicism; the ability for nursing staff to adequately assess pain in those unable to communicate; insufficient documentation of pain in nursing notes, and challenges in the communication between the ACF and staff. Based on these findings, and noted below in Table 25 and Table 26, which summarise the barriers and enablers to the pharmacological pain management, there are a number of overlapping factors found in the different studies, particularly in relation to education, challenges with the wider health system and patient-related barriers.

Table 25 Barriers to the optimal management of pain

Patient factors	-	Poor patient reporting of pain;
	-	Difficulty in identifying pain in patients with cognitive impairment;
	-	Patient stoicism and reluctance to take analgesics;
	-	Patient knowledge, health literacy and expectations;
	-	The influence of family on pain and its management;
	-	The usefulness and validity of pain scales.
Communication factors	-	Poor and slow communication between hospitals and GPs regarding post-discharge care;
	-	Variable discharge counselling to patients on discharge following a surgical procedure;
	-	Poor communication and management agreement between ACF and GPs;
	-	Lack of post discharge resources and follow-up for surgical patients.
Wider health system factors	-	Poor access and long waiting times for pain clinic services;
	-	Poor access to Government funded allied health services for persistent pain management in the community;
	-	Poor staffing on surgical wards, reducing acute pain management capacity and treatment modalities;
	-	Underutilisation of anaesthetists, pain specialists or APS in the post-surgical period;
	-	Conflicting priorities and goals following surgery influencing the management of pain.
Education	-	Limited training as part of the undergraduate medical degree in pain and its management despite its prevalence within society.

ACF: aged care facilities; GP: general practitioners

Table 26 Potential ways to overcome these barriers

Education	- Increased education of patients regarding expectations, management, analgesics, their side effects and how to take them; - Increased education of GPs regarding pain management; - Increased education of allied health professions to allow for increased specialisation in the management of persistent pain conditions; - Increased education of hospital nursing staff regarding identification and management of pain; - Increased education of ACF nursing staff regarding identification and management of pain; - A systematic approach across all Australian universities to increase pain management training as part of all undergraduate medical, nursing and allied health care practitioner courses.
Post-discharge management	- Improved content and consistency of counselling and resources for patients regarding post-discharge pain management; - Improved discharge planning and provision of discharge medication; - Increased involvement of anaesthetists, pain specialists or APS in all post-surgical patients' care; - Early identification of neuropathic pain following surgery; - Improved speed of post-discharge communication with GPs about patients.
Wider health system factors	- Increased funding and access to pain clinics; - Increased MBS funding of psychology and physiotherapy for persistent pain conditions; - Increased time available for GP appointments, particularly in regard to pain; - Increased hospital staffing to allow for increased access to analgesics, and treatment modalities and monitoring of pain.
Further research and evaluation of initiatives	- Increased APS and/or pain specialists services following surgery and discharge for all post-surgical patients (including neuropathic pain assessment); - The development of improved patient resources and discharge counselling for post-surgical patients; - The identification of the predictors of PPP and development of an associated assessment tool; - The development of pre-operative interventions to overcome psychological factors associated with PPP; - Improved documentation of pain and protocols regarding pain management and the reporting of pain in ACFs; - Reviews of the management of pain, documenting frequency of pain reports and management strategies incorporating both non-pharmacological and pharmacological management; and - Increased pain management role for pharmacists within or associated with GP clinics.

ACF: aged care facilities; GP: general practitioner; MBS: Medical Benefits Scheme; APS: Acute Pain Service; PPP: persistent post-operative pain

Identification of these barriers and the resulting proposals regarding approaches to overcome them add greatly to the current literature, particularly in the Australian context. However, a

number of these have been previously identified, including patient stoicism and reluctance to take analgesics (404, 437, 541, 543-545) in older people in particular, poor access to pain clinics (472), and the need for increased training of health professionals regarding pain at undergraduate and postgraduate level (492, 493). Where this research significantly adds to the literature is in relation to the quality of post-discharge counselling and prescribing, and the resultant under management of post-discharge pain. Poor post-discharge pain management was identified by GPs, patients and anaesthetists as a problem and patient self-management was often suboptimal in the studies carried out. Although high levels of post-discharge pain have been identified previously (204, 393-397), the findings of this thesis, associating uncontrolled post discharge pain with PPP, add weight to the argument for improving the management of post-discharge pain. Another area where the results significantly add to the literature, is in the post-surgical management of patients and lack of involvement by pain specialists in the care of all post-surgical patients. These two areas have the potential, if rectified, to facilitate improved management of pain and a subsequent increase in QOL for people following surgery, together with a potentially reduced incidence and severity of PPP. In addition, Chapter 10 is the first study conducted in Australia evaluating the barriers and enablers to pain management in ACFs. This provides Australian specific barriers and enablers to managing pain. Considering the number of QUM issues identified in chapters 6 and 7, it is an imperative that the way pain in ACFs is managed and addressed, is further researched so that these residents can experience the best possible quality of life.

11.3 Implications and recommendations

The first key implication of this research is the need to improve the management post-discharge pain following surgery. Post-discharge pain management is sub-optimal for a variety of reasons including patient reluctance to take analgesics, poor discharge counselling, inadequate provision of post-discharge analgesics and poor guidance around what patients should do if there is a problem. These issues were identified from a number of perspectives including patients, GPs and anaesthetists. From Chapter Five in particular, as well as previous studies (208, 388, 389, 395, 396), there appears to be an association between moderate to severe post-discharge pain and the development of PPP. Previous studies have clearly articulated the risk of PPP increasing if acute postoperative pain (within the first 48 hours) levels are high (82, 202, 203). Consequently, the following question must be asked; why is there not more attention given to how patients manage pain when they go home? It is conceivable that the risk of peripheral and central sensitisation persists beyond 48 hours after surgery and optimal pain management following discharge may reduce the risk of sensitisation occurring. Many of the factors previously identified as contributing to PPP such as psychological and biological factors are difficult to augment to reduce

the incidence, other than identifying those at risk and managing these patients more aggressively. Improving the way post-discharge pain is managed has the potential to reduce the incidence and/or severity of PPP and at a minimum improve patients' QOL and physical function. Further research is needed to assess any intervention aimed at improving post-discharge pain on the incidence and severity of PPP. Any research should take into consideration older Australians in relation to predictors of PPP, as well as patient characteristics that may make these patients less likely to take analgesics following discharge.

Unfortunately, the complex range of factors and influences on these, mean that rectifying deficiencies in pain management will be challenging. Increasing the reach and role of the APS to incorporate all post-surgical patients' pain management and discharge counselling may assist in overcoming some of these barriers. Hospitals also need to have clear policies in place as to whose responsibility it is to provide discharge counselling regarding pain management and in doing so, ensuring they have relevant and adequately trained staff to accommodate this process. This can clearly be seen in Chapter Three and is also supported by anaesthetists' opinions in Chapter Nine, where so many different providers gave advice to patients with poor consistency in counselling, despite this study being conducted in just one hospital.

Further research needs to be undertaken involving interviews with patients about the content and delivery of information provided regarding pain management, following surgical discharge. Attempts should be made to determine what patients believe would assist them with their self-management of pain, particularly given the personal, family and societal influences on attitudes and perceptions to pain. This bottom-up approach needs to be adopted as there are so many misconceptions about pain and its management, especially in older patients.

The second key implication of this research is the way in which pain is managed by GPs and their lack of concordance with guidelines and recommendations. As noted previously, GPs are time poor, they are often under supported in the community by pain specialists, waiting times for pain clinics are long, or there are not pain clinics in the geographic area, and access to allied health services, particularly physiotherapy and psychology, is poor. These pressures, however, do not release GPs from practicing in accordance with guidelines or undertaking harm minimisation activities such as opioid trials. How to improve the management of pain by GPs and increase the use of these harm minimisation strategies needs to be further researched.

Although not ideal, there may be a requirement to put in place further administrative requirements regarding the prescribing of opioids to ensure that GPs commence these as a trial for patients, that they have optimised non-opioid analgesics before commencing opioids and that patients are not taking regular benzodiazepines in combination with opioids. This is particularly

pertinent in older patients who are at greatest risk of this combination causing harm. In the shorter term, trying to increase the level of CPD about pain management or a mandated minimum number of CPD points related to pain education is likely to benefit patients and GPs. Additionally, increasing the reach of persistent pain clinics so that GPs feel more supported in the community, and increased access to allied health services are also likely to benefit patients. However, increased access to pain clinics and allied health services would require major policy and fiscal changes, and significant government intervention for this to occur, which could be a major barrier to change in the current economic climate. Further research should be undertaken to assess the role of pharmacists in GP clinics and the effect that this increased collaboration may have on the management of pain and its management.

The final major implication of this research is the need for more education of health care practitioners (at an undergraduate and post graduate level) and patients regarding pain and its management. This has previously been suggested in the National Pain Strategy (35, 36) and is clearly an area where more work is required. Low levels of knowledge in relation to pain was cited by patients, GPs, anaesthetists and ACF staff as a barrier to optimal pain management. Health care practitioners need to improve their knowledge across the board in relation to pain management. This education should be firstly implemented at an undergraduate level in all health professional degrees. This would require a national and coordinated response to ensure all graduates have a similar level of knowledge and skills. This is likely to be best achieved by the Councils overseeing university course accreditations mandating a specific amount of training regarding pain and persistent pain management in order for the course to remain accredited.

Training for nursing staff already working is likely to have the best outcome if it is in person and on site. Although the recent University of Tasmania MOOC on dementia care has had good uptake (7,909 completed of 23,347 enrolled) (554), it has also had substantial number of people not complete it. It is possible that face-to-face education may facilitate increased completion of, and engagement in, training. For those working with post-surgical pain, training on site, peer-learning from increased APS or anaesthetists' involvement on the wards, or online training may all be useful tools in improving acute post-surgical pain management.

Patients, particularly older patients, were found in this thesis to demonstrate a reluctance to report pain and take analgesics. However, there is also the converse situation where patients are reliant on or expecting analgesics to "fix" their pain. A comprehensive patient education program is needed to improve patient knowledge, expectations and patient outcomes. Potentially, the use of accredited pharmacists, with additional pain management training, providing medication reviews in the community or pharmacists working in general practice may be other helpful

strategies. Intervention by pharmacists could assist patients by providing information and establishing realistic expectations and assist GPs in providing optimised management strategies for those with persistent pain conditions. This may relieve some pressure from GPs but still ensure patients are provided relevant, timely information to allow them to safely and effectively self-manage their pain. For post-surgical patients and those with persistent pain in the community, further work would need to be undertaken to determine the best method of delivering education such as identifying whether face-to-face, one on one or as a group, online or other types of information provision provided the best patient outcomes. For those in ACFs it is likely face-to-face information sessions, preferably including patients' families would be most beneficial and likely to result in behaviour change. Intervention studies should be conducted to identify the best way in which this information should be presented and it's content.

In summary, based on the work in this thesis, the main recommendations for improved pain management in Australia are:

- Increased provision of education and training regarding pain and its management to undergraduate, graduate and qualified health care practitioners, particularly to those who will work closely with patients who experience pain;
- Increased patient education regarding pain, analgesics and expectations;
- Improved involvement by anaesthetists, pain specialists or the APS following a surgical procedure and at discharge;
- Improved and consistent discharge counselling and post-discharge resources for patients who have undergone a surgical procedure;
- Increased access for patients with persistent pain to funded multidisciplinary services, including pain clinics, psychologists, physiotherapists and pharmacist services; and
- Further research evaluating the effectiveness of the interventions suggested in this thesis, including pharmacist education in GP clinics, increased patient education on surgical discharge, pain specific follow-up after surgery, and the development and validation of a PPP assessment tool.

11.4 Limitations

Although this research contributes significantly to the area of pain and its management in Australia, it is important to acknowledge some limitations. Firstly, it is important to note that the pharmacological management of pain is only one treatment modality, and thus the results within this thesis only review this aspect. Multimodality management of pain is required in order to demonstrate significant improvements and this is a limitation with this study. In all studies an increased sample size would have been beneficial to improve the strength of the findings.

Nonetheless, the results were still convincing despite this. There was the potential, albeit small, that recall bias may have affected the results of surveys. Only one week's recall was required for the prospective studies included in this thesis, and for this reason, recall bias would be unlikely to influence the results. It would be useful to repeat the work conducted as part of Chapter Three in other hospitals, to further investigate the management of post-discharge pain. Nonetheless, the results of Chapter Three are consistent with Chapter Nine, an Australian-wide survey of anaesthetists. In Chapters Three, Eight and Nine, there may have been some self-selection of participants, as those interested in the area or with specific concerns may have been more likely to respond. Potentially this may have influenced the findings, although the effect of this is likely to be small and the results are consistent with previous studies in the area.

As noted in the text of Chapters Six and Seven, a number of potential limitations in the medical review data could exist, including the potential inaccurate or incomplete recording of data and being able to determine the frequency of "as required" analgesic dosing. Based on the responses of the ACF staff regarding pain management (Chapter Ten) "as required" analgesics dosing appears to be not overly common for chronic pain conditions. The staff noted that if a patient is requiring frequent "as required" medication, the doctor would be contacted and the order changed to more regular dosing. It would have been beneficial to conduct this research in parallel with an audit of ACFs to improve the generalisability of the results and conclusions drawn, in addition to tying it in with the non-pharmacological management strategies employed and nursing perspective. However, this is an avenue for further research to add to the literature in this area.

In hindsight, for the purposes of comparison it would have been beneficial to modify the surveys used in Chapter Four and Five. The same depression and anxiety scales should have been used for both cohorts to allow for better comparisons between the groups. It also would have been beneficial to have been able to include more intraoperative data and although efforts were made to try and obtain this, inconsistencies and poor recording of this data by surgeons (in accessible medical notes) meant that it was not possible to include it. This would have allowed for a more comprehensive data collection and clearer outcomes. In addition, the numerical rating scale was found to be difficult to administer, as patients struggled to rate their pain using this scale (this was also noted by the ACF staff in Chapter Ten) and consequently other questions using descriptors such as mild, moderate or severe pain or discomfort were often used to elicit a patient answer. When conducting further research in this area, more descriptive assessments of pain and its characteristics would be desirable and permit easier comprehension for patients regarding their pain and its management.

11.5 Conclusion

This thesis significantly adds to the literature concerning the pharmacological management of pain in older Australia and the predictors of PPP, particularly the influence of undermanagement of pain following hospital discharge, which has been not been previously researched. Overall the key findings of this thesis are that pain is often undermanaged following hospital discharge after surgery, with inconsistent discharge planning, counselling and prescribing, and a lack of concordance with guidelines and recommendations by GPs managing pain in the elderly leading to potentially deadly drug combinations being prescribed. These findings led to a number of recommendations being made to improve pain management, including increased education of health professionals and patients, increased involvement of pain specialists following surgery, improved discharge counselling and resources for patients following surgery, and increased access to funded multidisciplinary services including pain clinics, psychologists and physiotherapists. With improved management of post-discharge pain there is the potential to reduce the incidence of PPP in the future and at the very least improve the QOL and rehabilitation potential following discharge. Additionally, increased GP knowledge and access to multidisciplinary resources may help reduce the severity of pain and improve physical function of those patients who do experience persistent pain to allow them to have an improved QOL. It is clear that significant improvements to pharmacological pain management are required in order to optimise treatment outcomes for elderly Australians.

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Appendix 1: Provision of pain management advice to surgical patients at the Royal Hobart Hospital – elective patients

Provision of Pain Management Advice to Surgical Patients at the Royal Hobart Hospital

Many thanks for completing this survey, please answer as many questions as you are able to. If you find you need help to answer this survey, please feel free to ask a family member or a friend who was involved in your care during your hospital stay. We do appreciate your honesty and all answers shall be kept strictly confidential.

Date of Birth:..... Gender: ☐ Male ☐ Female
Today's date:.....

1a) How would you describe your current employment situation?
☐ Full time ☐ Part time ☐ Casual ☐ Full time student
☐ Unemployed ☐ Retired ☐ Other ☐ Disability pension

1b) What is the highest level of education you have completed?
☐ Pre-year 10 ☐ Year 10 ☐ Year 12 ☐ Diploma
☐ VET Certificate ☐ Bachelor's degree ☐ Post-graduate Qualification

2a) In a pre-assessment clinic did you speak to a doctor (from the surgical team or anaesthetist) about your postoperative pain management before you were admitted to hospital to have your operation?
☐Yes ☐No (Please go to question 3a)

2b) Did the doctor give you any written information at this session?
☐ Yes ☐ No

3a) Were you experiencing pain before you had surgery?
☐ Yes ☐ No (Please go to Question 4)

3b) On average, how severe would you rate your level of pain before surgery?
(0 being no pain and 10 being worst pain imaginable)?
☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

3c) Was this pain (or the medical condition causing this pain) the reason you had surgery?
☐ Yes ☐ No

3d) For how long had you been suffering with this pain?
☐ Less than 3 months ☐ 3-6 months ☐ 6-12 months ☐ More than 12 months

4a) Following discharge from hospital after your operation, what medicine(s) have you been taking for your pain ?
If not listed, please at the blank spaces provided.

Drug	Strength	Number of tablets per day	Provided by the hospital on discharge? (Yes/No)	If no, where did you get these medicines from? Eg. Supermarket, pharmacy, GP prescription, friend/family, old medication of my own
Paracetamol (Panadol®, Panamax®)				
Ibuprofen (Nurofen®, Brufen®)				
Paracetamol/codeine (Panadeine Forte®, Panadeine Extra®, Codalgin Forte®, Codapane Forte®)				
Ibuprofen/codeine (Nurofen Plus®)				
Naproxen (Naprosyn®, Inza®, Naprogesic®)				
Diclofenac (Voltaren®)				
Meloxicam (Mobic®)				
Celecoxib (Celebrex®)				
Codeine				
Oxycodone (Endone®, Oxynorm®)				
Buprenorphine patch (Norspan®)				
Fentanyl patch (Durogesic®, Fenpatch®)				
Morphine (MS Mono® MS Contin®, Kapanol®)				
Tramadol (Tramal®, Zydol®)				
Gabapentin (Neurontin®)				
Pregabalin (Lyrica®)				
Duloxetine (Cymbalta®, Andepra®)				

4b) Apart from taking medicine(s), have you been doing anything else to reduce your pain? (e.g. heat/cold packs, massage, physiotherapy)

……
……

5a) Right now, how severe would you rate your level of pain?
(0 being no pain and 10 being worst pain imaginable)?

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

5b) Thinking about the last 7 days since you were discharged from hospital, how severe would you rate your **average** level of pain?
(0 being no pain and 10 being worst pain imaginable)?

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

5c) What level of pain severity did you expect to have 7 days after discharge from hospital?
(0 being no pain and 10 being worst pain imaginable)?

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

6a) When you were admitted to hospital for your operation, what information was given to you (before your operation and at discharge) about how to manage your pain once you were at home? (Tick all that apply)

☐ Number of tablets to take
☐ What medications to take
☐ When to contact the hospital
☐ What activities you can do after the surgery
☐ Other

……
……
……
……
……
……
……

6b) Were you given any written information?

☐Yes ☐No

6c) Who provided you with this advice / information? (Tick all that apply)

☐ Doctor ☐ Nurse ☐ Pharmacist ☐ Anaesthetist

6d) Have you followed this advice about pain medicines?

☐ Yes (If yes continue question 7) ☐ No

6e) Please tell us why you have chosen not to follow this advice.
☐ Side effects of medication
☐ Did not understand
☐ Too complicated
☐ Not in pain
☐ Cost of medication
☐ Difficulty in obtaining supplies
Other……
……..

7a) Have you been using your medication:
☐ More than directed
☐ As directed (go to question 8)
☐ Less than directed

7b) Please tell us why you have found it necessary to use more or less of the pain medicine(s) than advised
……
……
……
8) Please tell us any other information about your pain management that you think may be useful to our project
……
……
……

Appendix 2: Provision of pain management advice to surgical patients at the Royal Hobart Hospital - emergency patients

Provision of Pain Management Advice

to Surgical Patients at the Royal Hobart Hospital

Many thanks for completing this survey, please answer as many questions as you are able to. If you find you need help to answer this survey, please feel free to ask a family member or a friend who was involved in your care during your hospital stay. We do appreciate your honesty and all answers shall be kept strictly confidential.

Name: .....

Date of Birth:..... Gender: ☐ Male ☐ Female

Today's Date: ……

1a) How would you describe your current employment situation?

☐ Full time ☐ Part time ☐ Casual ☐ Full time student

☐ Unemployed ☐ Retired ☐ Other ☐ Disability pension

1b) What is the highest level of education you have completed?

☐ Pre-year 10 ☐ Year 10 ☐ Year 12 ☐ Diploma

☐ VET Certificate ☐ Bachelor's degree ☐ Post-graduate Qualification

2a) Did you speak to an anaesthetist or doctor from the surgical team about your postoperative pain management before your operation?

☐Yes ☐No (Please go to question 3a)

2b) Were you given written information at this time?
☐ Yes ☐ No

3a) Were you experiencing pain before you had surgery?
☐ Yes ☐ No (Please go to Question 4)

3b) Where was this pain?
……
……

3c) On average, how severe would you rate your level of pain before surgery?
(0 being no pain and 10 being worst pain imaginable)?
☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9 ☐10

3d) How long have you have this pain for?
☐ <3 months ☐ 3-6 months ☐ 6-9 months ☐ 9-12 months
☐ 1-2 years ☐ 2-5 years ☐ 5-10 years ☐ >10 years

4a) Following discharge from hospital after your operation, what medicine(s) have you been taking for your pain?

If not listed, please at the blank spaces provided.

Drug	Strength	Number of tablets per day	Provided by the hospital on discharge? (Yes/No)	If no, where did you get these medicines from? Eg. Supermarket, pharmacy, GP prescription, friend/family, old medication of my own
Paracetamol (Panadol®, Panamax®)				
Ibuprofen (Nurofen®, Brufen®)				
Paracetamol/codeine (Panadeine Forte®, Panadeine Extra®, Codalgin Forte®, Codapane Forte®)				
Ibuprofen/codeine (Nurofen Plus®)				
Naproxen (Naprosyn®, Inza®, Naprogesic®)				
Diclofenac (Voltaren®)				
Meloxicam (Mobic®)				
Celecoxib (Celebrex®)				
Codeine				
Oxycodone (Endone®, Oxynorm®)				
Buprenorphine patch (Norspan®)				
Fentanyl patch (Durogesic®, Fenpatch®)				
Morphine (MS Mono® MS Contin®, Kapanol®)				
Tramadol (Tramal®, Zydol®)				
Gabapentin (Neurontin®)				
Pregabalin (Lyrica®)				
Duloxetine (Cymbalta®, Andepra®)				

4b) Apart from taking medicine(s), have you been doing anything else to reduce your pain? (e.g. heat/cold packs, massage, physiotherapy)

……
……

5a) Right now, how severe would you rate your level of pain?
(0 being no pain and 10 being worst pain imaginable)?

☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9 ☐10

5b) Thinking about the last 7 days since you were discharged from hospital, how severe would you rate your **average** level of pain?
(0 being no pain and 10 being worst pain imaginable)?

☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9 ☐10

5c) What level of pain severity did you expect to have 7 days after discharge from hospital?
(0 being no pain and 10 being worst pain imaginable)?

☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9 ☐10

6a) What information was given to you in hospital (before and at discharge) about how to manage your pain once you were at home?

☐ Number of tablets to take
☐ What medications to take
☐ When to contact the hospital
☐ What activities you can do after the surgery
☐ Other

……
……
……
……
……
……

6b) Were you given any written information?
☐Yes ☐No

6c) Who provided you with this information? (Tick all that apply)
☐Doctor ☐Nurse ☐Pharmacist ☐Anaesthetist

6d) Have you followed the advice that was given to you?
☐ Yes (If yes continue question 7) ☐ No

6e) Why have you chosen not to follow this advice?

☐ Side effects of medication
☐ Did not understand
☐ Too complicated
☐ Not in pain
☐ Cost of medication
☐ Difficulty in obtaining supplies

Other:……

7a) Are you using you medication:
☐ More than directed
☐ As directed (go to question 8)
☐ Less than directed

7b) Please tell us why you have found it necessary to use more or less of the pain medicine(s) than advised
……
……
……
8) Please tell us any other information about your pain management that you think may be useful to our project
……
……
……

Appendix 3: The management of postoperative pain - sternotomy

Many thanks for completing this survey, please answer all of the questions. We apologise if some of the questions seem too personal or confronting. We do appreciate your honesty and all answers shall be kept strictly confidential.

Name: .....
Age:..... Gender: ☐ Male ☐ Female
Do you have any allergies: ……..

Postcode: ……..
Phone number: ……..

1a) How would you describe your marital status:
☐ Married ☐ Divorced ☐ De-facto relationship ☐ Other
☐ Widowed ☐ Single Prefer not to say

1b) How would you describe your current employment situation?
☐ Full time ☐ Part time ☐ Casual ☐ Full time student
☐ Unemployed ☐ Retired ☐ Other ☐ Disability pension

1c) Do you intend to return to work after your surgery?
☐ Yes ☐ No ☐ Maybe ☐ Not applicable

1d) What is the highest level of education you have completed?
☐ Pre-year 10 ☐ Year 10 ☐ Year 12 ☐ Diploma
☐ VET Certificate ☐ Bachelor's degree ☐ Post-graduate Qualification

1e) Are you a cigarette/pipe/cigar smoker? ☐ Yes ☐ No

1f) In an average week how many standard drinks of alcohol do you drink?.....
1 can/bottle beer = 1 1 glass of wine = 1.5
1 nip (30mL) spirits = 1 pre-mix/redi-mix bottle/can = 1.5

1g) Do you have support (either friends or family) that can assist you when you are discharged from hospital? ☐ Yes ☐ No ☐ Maybe

1h) On a scale of 1 to 10 (one being not positive/optimistic to 10 being very positive/optimistic) do you consider yourself to be a positive/optimistic person?

1 2 3 4 5 6 7 8 9 10

1i) On a scale of 1 to 10 (one being very unhealthy to 10 being very healthy) what level of health do you think you have?

1 2 3 4 5 6 7 8 9 10

1j) On a scale of one to 10 (one being able to cope with pain very well and 10 being unable to cope with pain very well) what level of pain tolerance do you think you have?

1 2 3 4 5 6 7 8 9 10

1k) On a scale of 1 to 10 (one being not scared/concerned to 10 being very concerned/scared) how worried are you about postoperative pain?

1 2 3 4 5 6 7 8 9 10

1l) Did you speak to an anaesthetist or doctor about your pain management before you had your operation?

Yes ☐ No ☐

2a) Are you currently experiencing any pain?

☐ Yes ☐ No (Please go to Question 3)

2b) Is this pain the reason you are having surgery?

☐ Yes ☐ No

2c) Where is the site(s) of your pain?.....
.....
.....

2d) How long have you have this pain for?

☐ <3 months ☐ 3-6 months ☐ 6-9 months ☐ 9-12 months
☐ 1-2 years ☐ 2-5 years ☐ 5-10 years ☐ >10 years

2e) How many days a week do you experience this pain?.....

2f) Is your pain worst at rest or when you were moving? ……..
.....

2g) Do you know what caused your pain? (eg. Car accident, arthritis, cancer, previous surgery).....
.....

2h) What is the highest level of pain you experience during an average day on a scale of one to ten? (One being no pain and 10 being the worst pain you can imagine)

1 2 3 4 5 6 7 8 9 10

2i) What is the average pain level across a week on a scale of one to ten that you experience? (One being no pain and 10 being the worst pain you can imagine)

1 2 3 4 5 6 7 8 9 10

2j) Does this pain affect any of the following: (on a scale of 1-10 with one being no effect and 10 being extremely effected)

Sleep	
Activities of daily living (dressing, personal hygiene, self feeding, toileting)	
Sit in a car for >30 minutes	
Walk 100m	
Hobbies	

2k) What do you take to treat your pain? (Please include any over-the-counter medications or prescription medications that you have been taking)

Drug	Strength	Number of tablets per day
Paracetamol		
Ibuprofen		
Paracetamol/codeine		
Ibuprofen/codeine		
Naproxen		
Diclofenac		
Piroxicam/meloxicam		
Codeine		
Oxycodone XR/IR		
Buprenorphine patch		
Fentanyl patch/tab		
Morphine XR/IR		
Tramadol		
Methadone		
Di-Gesic/Capadex		
Gabapentin		
Pregabalin		
Lamotrigine		
Topiramate		
Valproic Acid		
Amitriptyline		
Venlafaxine		
Desvenlafaxine		

Question 3: For each statement please choose a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:
0 - Did not apply to me at all
1 – Applied to me to some degree, or some of the time
2 – Applied to me a considerable degree, or a good part of time
3 – Applied to me very much, or most of the time

1	I found it hard to wind down	0	1	2	3
2	I was aware of dryness of my mouth	0	1	2	3
3	I couldn't seem to experience any positive feeling at all	0	1	2	3
4	I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5	I found it difficult to work up the initiative to do things	0	1	2	3
6	I tended to over-react to situations	0	1	2	3
7	I experienced trembling (eg, in the hands)	0	1	2	3
8	I felt that I was using a lot of nervous energy	0	1	2	3
9	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10	I felt that I had nothing to look forward to	0	1	2	3
11	I found myself getting agitated	0	1	2	3
12	I found it difficult to relax	0	1	2	3
13	I felt down-hearted and blue	0	1	2	3
14	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15	I felt I was close to panic	0	1	2	3
16	I was unable to become enthusiastic about anything	0	1	2	3
17	I felt I wasn't worth much as a person	0	1	2	3
18	I felt that I was rather touchy	0	1	2	3
19	I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0	1	2	3
20	I felt scared without any good reason	0	1	2	3
21	I felt that life was meaningless	0	1	2	3

Everyone experiences painful situations at some point in their lives. Such experiences may include headaches, tooth pain, joint or muscle pain. People are often exposed to situations that may cause pain such as illness, injury, dental procedures or surgery.

We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are thirteen statements describing different thoughts and feelings that may be associated with pain. Using the following scale, please indicate the degree to which you have these thoughts and feelings when you are experiencing pain.

0 – not at all **1** – to a slight degree **2** – to a moderate degree **3** – to a great degree **4** – all the time

When I'm in pain …

I worry all the time about whether the pain will end.	0	1	2	3	4
I feel I can't go on.	0	1	2	3	4
It's terrible and I think it's never going to get any better.	0	1	2	3	4
I feel I can't stand it anymore.	0	1	2	3	4
I become afraid that the pain will get worse.	0	1	2	3	4
I keep thinking of other painful events.	0	1	2	3	4
It's awful and I feel that it overwhelms me	0	1	2	3	4
I anxiously want the pain to go away.	0	1	2	3	4
I can't seem to keep it out of my mind.	0	1	2	3	4
I keep thinking about how much it hurts.	0	1	2	3	4
I keep thinking about how badly I want the pain to stop.	0	1	2	3	4
There's nothing I can do to reduce the intensity of the pain.	0	1	2	3	4
I wonder whether something serious may happen.	0	1	2	3	4

Appendix 4: Follow-up survey – 10 days and 2 months post-discharge

Date: .....

Patient Name: .....

Thinking about your surgery and the area that was operated on, please answer the following.

1a) Are you currently experiencing any pain at the site of your operation? (one being no pain and 10 being the worst pain imaginable)

1 2 3 4 5 6 7 8 9 10

1b) At this site, what is the worst level of pain you have experienced in the past week? (one being no pain and 10 being the worst pain imaginable)

1 2 3 4 5 6 7 8 9 10

1c) On average, what level of pain have you had over the last week at the site of the operation? (one being no pain and 10 being worst pain imaginable)

1 2 3 4 5 6 7 8 9 10

1d) Does this pain affect any of the following: (on a scale of 1-10 with one being no effect and 10 being extremely effected)

Sleep	
Activities of daily living (dressing, personal hygiene, self-feeding, toileting)	
Sit in a car for >30 minutes	
Walk 100m	
Hobbies	

2) What medications are you currently taking for your pain?

Drug	Strength	Number of tablets per day	Who is your prescriber?
Paracetamol			
Ibuprofen			
Paracetamol/codeine			
Ibuprofen/codeine			
Naproxen			
Diclofenac			
Piroxicam/meloxicam			
Codeine			
Oxycodone XR/IR			
Buprenorphine patch			
Fentanyl patch/tab			
Morphine XR/IR			
Tramadol			
Methadone			
Di-gesic/Capadex			
Gabapentin			
Pregabalin			
Lamotrigine			
Topiramate			
Valproic Acid			
Amitriptyline			
Venlafaxine			
Desvenlafaxine			

If you were working or studying prior to surgery have you returned to work?

☐ Yes ☐ No

Are you working the same number of hours as you were prior to surgery?

☐ Yes ☐ No – fewer hours ☐ No – more hours

Appendix 5: Follow-up survey – 3 and 12 months after surgery

Date: .....

Patient Name: .....

1) Have you had any new medical conditions diagnosed in the last three months?

……

2) Thinking about your surgery and the area that was operated on, please answer the following.

2a) Are you currently experiencing any pain at the site of your operation? (one being no pain and 10 being the worst pain imaginable)

1 2 3 4 5 6 7 8 9 10

2b) At this site, what is the worst level of pain you have experienced in the past week? (one being no pain and 10 being the worst pain imaginable)

1 2 3 4 5 6 7 8 9 10

2c) On average, what level of pain have you had over the last week at the site of the operation? (one being no pain and 10 being worst pain imaginable)

1 2 3 4 5 6 7 8 9 10

2d) Does this pain affect any of the following: (on a scale of 1-10 with one being no effect and 10 being extremely effected)

Sleep	
Activities of daily living (dressing, personal hygiene, self-feeding, toileting)	
Sit in a car for >30 minutes	
Walk 100m	
Hobbies	

Question 1: Does the pain have one or more of the following characteristics?

	YES	NO
1 - Burning	❒	❒
2 - Painful Cold	❒	❒
3 - Electric Shocks	❒	❒

Question 2: Is the pain associated with one or more of the following symptoms in the same area?

	YES	NO
4 - Tingling	❒	❒
5 - Pins and Needles	❒	❒
6 - Numbness	❒	❒
7 - Itching	❒	❒

3) What medications or supplements are you currently taking for your pain, including anything bought at a pharmacy, health food store or supermarket (if you are not sure what a medication is used for please write it down)?

Drug	Strength	Number of tablets per day

4) Have you got any other pain not at the site of the surgery?
☐ yes – please continue onto question 4a
☐ no – many thanks for your time and assistance in completing this form.

4a) Where are the site(s) of your pain?
……
……
4b) How long have you have this pain for? ……
4c) How many days a week do you experience this pain?……
4d) Do you know what is causing your pain?……
4e) Are you having any treatment for this pain? Eg physiotherapy, further surgery, pain killers?
……
……

4f) At this site, which was not operated on, what is your current level of pain? (one being no pain and 10 being the worst pain imaginable)

1 2 3 4 5 6 7 8 9 10

4g) At this site not related to your operation, what is the worst level of pain you have experienced in the past week? (one being no pain and 10 being the worst pain imaginable)

1 2 3 4 5 6 7 8 9 10

4H) On average, what level of pain have you had over the last week at the site of pain not associated with your operation? (one being no pain at all and 10 being significant and constant pain)

1 2 3 4 5 6 7 8 9 10

4I) Does this pain effect: (on a scale of 1-10 with one being no effect and 10 being extremely effected)

Sleep	
Activities of daily living (dressing, personal hygiene, self-feeding, toileting)	
Sit in a car for >30 minutes	
Walk 100m	
Hobbies	

Appendix 6: The management of postoperative pain – orthopaedic initial survey

Many thanks for completing this survey, please answer all of the questions. We apologise if some of the questions seem too personal or confronting. We do appreciate your honesty and all answers shall be kept strictly confidential.

Name: .....
Age:..... Gender: ☐ Male ☐ Female
Do you have any allergies: ……..

Postcode: ……..
Phone number: ……..

1a) How would you describe your marital status:
☐ Married ☐ Divorced ☐ De-facto relationship ☐ Other
☐ Widowed ☐ Single

1b) How would you describe your current employment situation?
☐ Full time ☐ Part time ☐ Casual ☐ Full time student
☐ Unemployed ☐ Retired ☐ Other ☐ Disability pension

1c) What is the highest level of education you have completed?
☐ Pre-year 10 ☐ Year 10 ☐ Year 12 ☐ Diploma
☐ VET Certificate ☐ Bachelor's degree ☐ Post-graduate Qualification

1d) Are you a cigarette/pipe/cigar smoker? ☐ Yes ☐ No

1e) In an average week how many standard drinks of alcohol do you drink?.....
1 can/bottle beer = 1 1 glass of wine = 1.5
1 nip (30mL) spirits = 1 pre-mix/redi-mix bottle/can = 1.5

1f) Do you have support (either friends or family) that can assist you when you are discharged from hospital? ☐ Yes ☐ No ☐ Maybe

1g) On a scale of 1 to 10 (one being not positive/optimistic to 10 being very positive/optimistic) do you consider yourself to be a positive/optimistic person?

1 2 3 4 5 6 7 8 9 10

1h) On a scale of 1 to 10 (one being very unhealthy to 10 being very healthy) what level of health do you think you had prior to your emergency surgery?

1 2 3 4 5 6 7 8 9 10

1i) On a scale of one to 10 (one being able to cope with pain very well and 10 being unable to cope with pain very well) what level of pain tolerance do you think you have?

1 2 3 4 5 6 7 8 9 10

1j) On a scale of 1 to 10 (one being not scared/concerned to 10 being very concerned/scared) how worried were you about postoperative pain prior to your emergency surgery?

1 2 3 4 5 6 7 8 9 10

1k) Did you speak to an anaesthetist or doctor about your pain management before you had your operation?

Yes ☐ No ☐

1l) On a scale of 1 to 10 (one being very positive and 10 being very negative) how would you rate your current mood?

1 2 3 4 5 6 7 8 9 10

2a) Prior to your accident/incident that brought you into hospital, were you experiencing any pain?

☐ Yes ☐ No (Please go to Question 3)

2b) Where is the site(s) of your pain?.....
.....
.....

2c) How long have you have this pain for?

☐ <3 months ☐ 3-6 months ☐ 6-9 months ☐ 9-12 months
☐ 1-2 years ☐ 2-5 years ☐ 5-10 years ☐ >10 years

2d) How many days a week do you experience this pain?.....

2e) Is your pain worst at rest or when you were moving? ……..
.....

2f) Do you know what caused your pain? (eg. Car accident, arthritis, cancer, previous surgery).....
.....

2g) What is the highest level of pain you experience during an average day on a scale of one to ten? (One being no pain and 10 being the worst pain you can imagine)

1 2 3 4 5 6 7 8 9 10

2h) What is the average pain level across a week on a scale of one to ten that you experience? (One being no pain and 10 being the worst pain you can imagine)

1 2 3 4 5 6 7 8 9 10

2i) Does this pain affect any of the following: (on a scale of 1-10 with one being no effect and 10 being extremely effected)

Sleep	
Activities of daily living (dressing, personal hygiene, self feeding, toileting)	
Sit in a car for >30 minutes	
Walk 100m	
Hobbies	

2j) What do you take to treat your pain? (Please include any over-the-counter medications or prescription medications that you have been taking)

Drug	Strength	Number of tablets per day
Paracetamol		
Ibuprofen		
Paracetamol/codeine		
Ibuprofen/codeine		
Naproxen		
Diclofenac		
Piroxicam/meloxicam		
Codeine		
Oxycodone XR/IR		
Buprenorphine patch		
Fentanyl patch/tab		
Morphine XR/IR		
Tramadol		
Methadone		
Di-Gesic/Capadex		
Gabapentin		
Pregabalin		
Lamotrigine		
Topiramate		
Valproic Acid		
Amitriptyline		
Venlafaxine		
Desvenlafaxine		

Hospital Anxiety and Depression Scale (HADS)

GL assessment
the measure of potential

Name: _____ Date: _____

Clinicians are aware that emotions play an important part in most illnesses. If your clinician knows about these feelings he or she will be able to help you more.

This questionnaire is designed to help your clinician to know how you feel. Read each item below and **underline the reply** which comes closest to how you have been feeling in the past week. Ignore the numbers printed at the edge of the questionnaire.

Don't take too long over your replies, your immediate reaction to each item will probably be more accurate than a long, thought-out response.

FOLD HERE

A	D		A	D
		I feel tense or 'wound up'		
3		Most of the time		3
2		A lot of the time		2
1		From time to time, occasionally		1
0		Not at all		0
		I still enjoy the things I used to enjoy		
	0	Definitely as much		
	1	Not quite so much		
	2	Only a little		
	3	Hardly at all		
		I get a sort of frightened feeling as if something awful is about to happen		
3		Very definitely and quite badly		3
2		Yes, but not too badly		2
1		A little, but it doesn't worry me		1
0		Not at all		0
		I can laugh and see the funny side of things		
	0	As much as I always could		
	1	Not quite so much now		
	2	Definitely not so much now		
	3	Not at all		
		Worrying thoughts go through my mind		
3		A great deal of the time		
2		A lot of the time		
1		Not too often		
0		Very little		
		I feel cheerful		
	3	Never		
	2	Not often		
	1	Sometimes		
	0	Most of the time		
		I can sit at ease and feel relaxed		
0		Definitely		
1		Usually		
2		Not often		
3		Not at all		
		I feel as if I am slowed down		
		Nearly all the time		3
		Very often		2
		Sometimes		1
		Not at all		0
		I get a sort of frightened feeling like 'butterflies' in the stomach		
		Not at all	0	
		Occasionally	1	
		Quite often	2	
		Very often	3	
		I have lost interest in my appearance		
		Definitely		3
		I don't take as much care as I should		2
		I may not take quite as much care		1
		I take just as much care as ever		0
		I feel restless as if I have to be on the move		
		Very much indeed	3	
		Quite a lot	2	
		Not very much	1	
		Not at all	0	
		I look forward with enjoyment to things		
		As much as I ever did		0
		Rather less than I used to		1
		Definitely less than I used to		2
		Hardly at all		3
		I get sudden feelings of panic		
		Very often indeed	3	
		Quite often	2	
		Not very often	1	
		Not at all	0	
		I can enjoy a good book or radio or television programme		
		Often		0
		Sometimes		1
		Not often		2
		Very seldom		3

Now check that you have answered all the questions

FOLD HERE

A	D

TOTAL

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Everyone experiences painful situations at some point in their lives. Such experiences may include headaches, tooth pain, joint or muscle pain. People are often exposed to situations that may cause pain such as illness, injury, dental procedures or surgery.

We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are thirteen statements describing different thoughts and feelings that may be associated with pain. Using the following scale, please indicate the degree to which you have these thoughts and feelings when you are experiencing pain.

0 – not at all **1** – to a slight degree **2** – to a moderate degree **3** – to a great degree **4** – all the time

When I'm in pain …

I worry all the time about whether the pain will end.	0	1	2	3	4
I feel I can't go on.	0	1	2	3	4
It's terrible and I think it's never going to get any better.	0	1	2	3	4
I feel I can't stand it anymore.	0	1	2	3	4
I become afraid that the pain will get worse.	0	1	2	3	4
It's awful and I feel that it overwhelms me	0	1	2	3	4
I keep thinking of other painful events.	0	1	2	3	4
I anxiously want the pain to go away.	0	1	2	3	4
I can't seem to keep it out of my mind.	0	1	2	3	4
I keep thinking about how much it hurts.	0	1	2	3	4
I keep thinking about how badly I want the pain to stop.	0	1	2	3	4
There's nothing I can do to reduce the intensity of the pain.	0	1	2	3	4
I wonder whether something serious may happen.	0	1	2	3	4

Appendix 7: Management of pain - a survey of general practitioners' opinions

Thank you for taking the time to do this survey. As part of this research we are trying to identify what guidelines you use to manage patients with pain, how you would treat patients in a number of given scenarios and what barriers you think exist to the optimal management of pain and how these could be overcome.

This survey should take no more than 10 minutes to complete. If you decide that you do not want to complete this study, please exit the survey and your results will not be included in the final analysis. There are five Coles-Myer vouchers available valued at $100 each, if you wish to put your name in to the draw for one of these vouchers, please include your name and email address at the end. These details will not be linked with your response to the survey.

If you have any questions regarding this study, please do not hesitate to contact:

Felicity Veal (6226 2312; fveal@utas.edu.au) or

Associate Professor Luke Bereznicki (Luke.Bereznicki@utas.edu.au).

This project has been approved by the Tasmanian Health and Medical Human Research Ethics Committee. If you have concerns or complaints about the conduct of this project, please contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 6254 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number H0012833.

What guides decision making about pain management in general practice?

How many years have you been working in general practice?

On average, how many patients would you see each week with the following types of pain?

Number of patients, on average, per week

- Acute pain
- Persistent non-malignant pain
- Neuropathic pain
- Persistent malignant pain
- Palliative care

When managing patients with persistent/chronic pain which of the following guidelines do you use?

- ☐ Therapeutic Guidelines
- ☐ WHO analgesic ladder
- ☐ Hunter New England Pain Guidelines
- ☐ Quick Clinical Guideline for the use of opioids in chronic non-malignant pain (WA Govt)
- ☐ RACGP guideline for the non-surgical management of hip and knee osteoarthritis
- ☐ APSOC Pain in residential aged care facilities - Management strategies 2005
- ☐ NSW Therapeutic Assessment Group - Low Back Pain
- ☐ NSW Therapeutic Assessment Group - Preventing and managing problems with opioids prescribing for chronic non cancer pain
- ☐ Other:

Do you use any of the following strategies when prescribing opioids?

- ☐ Discussion around pain management expectations
- ☐ Opioid Trials of ~8 weeks
- ☐ Urine drug screening to monitor compliance and inappropriate drug taking
- ☐ Referral for cognitive behavioural therapy
- ☐ Referral for physiotherapy
- ☐ Regular reviews of the 5As (activity; adverse events; aberrant behaviour; affect; analgesia)
- ☐ Other:

Please indicate how you think patients generally take their prescribed analgesics for ACUTE pain

	Less than prescribed	As prescribed	More than prescribed
Paracetamol	○	○	○
NSAIDs	○	○	○
Regularly prescribed opioids	○	○	○
As required opioids	○	○	○

Please indicate how you think patients generally take their prescribed analgesics for CHRONIC/PERSISTENT pain

	Less than prescribed	As prescribed	More than prescribed
Paracetamol	○	○	○
NSAIDs	○	○	○
Regularly prescribed opioids	○	○	○
As required opioids	○	○	○

For those patients who are non-compliant with analgesics, what do you think are the major reasons for non-compliance?

- ☐ Poor analgesic effect
- ☐ Misuse/diversion
- ☐ Tablet burden
- ☐ Reserving the analgesics for severe pain
- ☐ Fear of addiction
- ☐ Fear that it won't work if they use it too often
- ☐ Fear of pain
- ☐ Pain catastrophising
- ☐ Other:

Which of the following do you think are the major barriers to the management of persistent pain in general practice?

- ☐ Guidelines are difficult to use
- ☐ Lack of supporting evidence surrounding analgesics
- ☐ Lack of drug efficacy
- ☐ Side effect profile/risk of drugs
- ☐ Concern regarding misuse/diversion of analgesia
- ☐ Limited government funding of physiotherapy
- ☐ Difficult access to psychologists
- ☐ Waiting times to access pain clinics
- ☐ Patient expectations of pain management
- ☐ Diagnosis of pain causing condition
- ☐ Limited options for neuropathic pain on the PBS
- ☐ Other:

How do you think these barriers to pain management could be overcome?

Appendix 8: Management of postoperative pain - a survey of anaesthetists' opinions

Thank you for taking the time to do this survey. As part of this research we are trying to identify what factors affect your clinical decision making and what barriers you think exist to the optimal management of acute postoperative pain and how these could be overcome.

This survey should take no more than 5-10 minutes to complete. If you decide that you do not want to complete this study, please exit the study and your results will not be included in the final analysis. There are five Coles-Myer vouchers available valued at $100 each, if you wish to put your name in to the draw for one of these vouchers, please include your name and email address at the end. These details will not be linked with your response to the survey.

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There are 12 questions in this survey

A survey of anaesthetists' opinion about the management and barriers to optimal pain management

Where do you work?

- ○ Public Hospital - Consultant
- ○ Public Hospital - Registrar
- ○ Private Hospital - Consultant
- ○ Private Hospital - Registrar
- ○ Both a Public and Private Hospital - Consultant
- ○ Both a Public and Private Hospital - Registrar

How long have you been working in anaesthetics?

On average how many operations would you attend each week?

Which type of surgery do you most frequently attend? (please select all that apply)

- ☐ Cardiothoracic
- ☐ Vascular
- ☐ Neurosurgery
- ☐ General
- ☐ Colorectal
- ☐ OB/GYN
- ☐ Orthopaedic
- ☐ Plastic/reconstruction
- ☐ Head/neck
- ☐ Paediatric
- ☐ Interventional radiological procedures
- ☐ Day procedures
- ☐ No specific area
- ☐ Other:

Which patient factor(s) do you consider increase the risk of ACUTE postoperative pain?

- ☐ Depression
- ☐ Anxiety
- ☐ Pain catastrophising
- ☐ Persistent pain - somatic
- ☐ Persistent pain - visceral
- ☐ Lower socioeconomic status
- ☐ Lower educational status
- ☐ Severity of pre-operative pain
- ☐ Duration of pre-operative pain
- ☐ Re-operation on the same site
- ☐ Other:

Which patient factor(s) do you consider increase the risk of PERSISTENT postoperative pain?

- ☐ Depression
- ☐ Anxiety
- ☐ Pain catastrophising
- ☐ Persistent pain - somatic
- ☐ Persistent pain - visceral
- ☐ Lower socioeconomic status
- ☐ Lower educational status
- ☐ Severity of pre-operative pain
- ☐ Duration of pre-operative pain
- ☐ Re-operation on the same site
- ☐ Other:

Which of following influences how you manage a patient during the perioperative period?

- ☐ Hospital/department protocol
- ☐ Australian guideline(s)
- ☐ International guideline(s)
- ☐ Patient factors
- ☐ Operation factors
- ☐ Clinical judgment
- ☐ Other:

If you identify a patient as high risk for ACUTE postoperative pain, how does your management differ from your standard management?

- ☐ Increased likelihood of using a regional anaesthesia
- ☐ Increased likelihood of using an epidural
- ☐ Increased likelihood of using a perioperative local anaesthetic
- ☐ Increased likelihood of using perioperative ketamine
- ☐ Increased likelihood of using perioperative parecoxib
- ☐ Increased likelihood of prescribing a short course of gabapentin or pregabalin
- ☐ Increased likelihood of prescribing patient controlled analgesia
- ☐ Increased likelihood of prescribing postoperative ketamine infusion
- ☐ Increased likelihood of prescribing postoperative local anaesthetic infusion
- ☐ Other:

If you identify a patient as high risk for PERSISTENT postoperative pain, how does your management differ from your standard management procedure?

- ☐ Increased likelihood of using an epidural
- ☐ Increased likelihood of using a regional anaesthesia
- ☐ Increased likelihood of using perioperative parecoxib
- ☐ Increased likelihood of using perioperative ketamine
- ☐ Increased likelihood of using a perioperative local anaesthetic
- ☐ Increased likelihood of prescribing a short course of gabapentin or pregabalin
- ☐ Increased likelihood of prescribing postoperative ketamine infusion
- ☐ Increased likelihood of prescribing postoperative local anaesthetic infusion
- ☐ Increased likelihood of prescribing patient controlled analgesia
- ☐ Other:

Which, if any, of these measures do you think would assist in reducing the incidence of persistent postoperative pain?

- ☐ Increased pre-surgical assessment to assess for psychological factors
- ☐ Identification of predictors of persistent postoperative pain for use as in assessment tool
- ☐ Pre-operative screening for pain catastrophising, anxiety and depression
- ☐ Increased post-surgical assessment of neuropathic pain
- ☐ Increased post-discharge follow-up
- ☐ Other:

What do you think is the major barrier(s) to the management of **acute** pain following surgery?

☐ Patients over using their analgesics
☐ Patients under using their analgesics
☐ Adverse events associated with medications
☐ Other:

What do you think is the major barrier(s) to the management of pain **following** hospital discharge?

☐ Patients over using their analgesics
☐ Patients under using their analgesics
☐ Patients undertaking activities beyond recommendations
☐ Slow/poor communication between hospital and GP regarding patient
☐ Other:

Many thanks for taking the time to complete this survey.

We appreciate your assistance.

If you wish enter the prize draw click the link below.